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TWENTY-EIGHTH ANNUAL REPORT

OF THE

State Department of Health

OF

NEW YORK

FOR THE YEAR ENDING DECEMBER 31, 1907

VOLUME II

Report of the Sanitary Engineering Division

ALBANY
J. B. LYON COMPANY, STATE PRINTERS
1908

STATE OF NEW YORK

No. 56.

IN SENATE

February 17, 1908.

TWENTY-EIGHTH ANNUAL REPORT

OF THE

STATE DEPARTMENT OF HEALTH

STATE OF NEW YORK.

Executive Chamber,

Albany, *February* 17, 1908.

To the Legislature:

I have the honor to transmit herewith the twenty-eighth annual report of the State Department of Health.

(Signed) CHARLES E. HUGHES

26793

NEW YORK STATE DEPARTMENT OF HEALTH

Division of Administration

Commissioner

Eugene H. Porter, M.A., M.D.

Secretary and Deputy Commissioner

Alec H. Seymour

Division of Sanitary Engineering

Chief Engineer	Theodore Horton, C.E.
Principal Assistant Engineer	H. B. Cleveland, C.E.
Special Assistant Engineer	Prof. H. N. Ogden, C.E.
Assistant Sanitary Engineer	H. W. Taylor, C.E.
Inspecting Engineer	C. F. Breitzke, C.E.

Special Engineering Inspectors

(Employed for portion of year only.)

C. L. Walker, C.E.
L. H. M. Whitney
Leigh Robartes
F. J. Seery, C.E.
A. B. Cudebec
J. Birkhahn

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Bender Laboratory — Director	R. M. Pearce, M.D.
Cancer Laboratory — Director	H. R. Gaylord, M.D.
Chief Sanitary Chemist	L. M. Wachter
Assistant Bacteriologist	M. C. Cunningham
Assistant Chemist	A. J. Slack

Division of Vital Statistics

Director	F. D. Beagle

Division of Communicable Diseases

Director	J. T. Wheeler, M.D.

Division of Publicity and Education

Director	Hills Cole, M.D.

Consulting Staff

Ophthalmologist	Herbert D. Schenck, M.D.
Dermatologist	Frederic C. Curtis, M.D.
Orthopedist	Harlan P. Cole, M.D.

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John L. Heffron, M.D.	Syracuse

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REPORT OF THE CHIEF ENGINEER

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:—I have the honor to submit herewith the annual report of the Engineering Division for the year ending December 31, 1907.

This year has been one of unusual activity with the Engineering Division. It has been marked, in the first place, by a considerable increase in the number of current or routine matters referred to the Division for investigation and report. It has been further marked by the completion of a number of important investigations and reports of a special nature having a direct and vital bearing upon the general public health of the State.

This increase in the volume of work and of the efficiency and celerity with which it has been executed has been made possible only through an addition in the number of permanent and temporary assistants assigned to the Division during the year, and the individual and conscientious efforts of each member of its staff.

During the early portion of the year the work of the Division was still carried on with the small organization of the previous year, comprising the Chief Engineer and two Assistant Engineers. In June there were appointed, under Civil Service, six temporary engineering assistants, whose time and services were mainly devoted to special investigations during the summer months. Although these appointments effected only temporary relief and were a welcome addition to the engineering force in its work at that season, it was not until later in the year that the Engineering Division was permanently and considerably strengthened by the appointment, under competitive Civil Service, of an additional Assistant Engineer and an Inspecting

Engineer. With these permanent additions then, and other slight changes in personnel, the Engineering Division may now be considered as organized on a relatively stable and firm basis; and though in numbers, as well as in facilities, it still has a meagre showing in comparison with similar engineering departments in other States, it is now in a vastly better position to carry on the important and increasing duties intrusted to it than in previous years.

The report has, with slight modification, been arranged in general conformity with the outline or abstract printed in the last annual report, as follows:

I. SEWERAGE AND SEWAGE DISPOSAL.
  (*a*) Examination of plans for sewerage and sewage disposal.
  (*b*) General investigations relating to sewerage and sewage disposal.
  (*c*) Preparation of plans for sewerage and sewage disposal for State institutions.

II. PROTECTION OF PUBLIC WATER SUPPLIES.
  (*a*) Examination of water supplies.
  (*b*) Preparation of rules for the protection of public water supplies.
  (*c*) Inspections of violations of rules for the protection of public water supplies.

III. INVESTIGATION OF COMPLAINTS RELATING TO STREAM POLLUTION.

IV. INVESTIGATION OF PUBLIC NUISANCES NOT ARISING FROM STREAM POLLUTION.

V. INVESTIGATIONS ORDERED BY THE GOVERNOR.

VI. INSPECTION OF RENDERING PLANTS.

VII. SPECIAL INVESTIGATIONS.

(*a*) Sanitary inspection of watersheds.
(*b*) Inspection of the sanitary condition of cities.
(*c*) Investigation of proposed water supply for Niagara Falls.
(*d*) Investigation of sewage disposal plants.
(*e*) Sanitary inspection of summer resorts.
(*f*) Investigation of the conditions of ice harvesting on the Mohawk and Hudson rivers.

From this outline and the subject-matter of the report it will be seen that the arrangement is in general conformity with the custom followed in former years, except that there has been omitted in this report a larger proportion of detailed correspondence having only local reference or interest. The space thus gained has been utilized for presenting reports of special investigations carried out by the Engineering Division, which are not only of more particular value to the people or communities to whom they refer, but are of greater interest, and perhaps value, to the public at large, both within and outside of the State.

Respectfully yours,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 1, 1908.

EXAMINATION OF PLANS

FOR

SEWERAGE AND SEWAGE DISPOSAL

EXAMINATION OF PLANS FOR SEWERAGE AND SEWAGE DISPOSAL

ALTAMONT

On August 19, 1907, original plans for a sewer system and sewage disposal plant for the village of Altamont were approved by the Commissioner and a permit was issued for the discharge of effluent from the plant into a branch of the Boezenkill.

AUBURN

On May 1, 1907, a certified copy of a resolution adopted by the common council of the city of Auburn was received from the city clerk, together with a plan of a proposed sanitary sewer in Swift street, requesting the approval of said plans by this Department.

On June 21, 1907, the following communication was addressed to City Clerk Hanlon; other correspondence following:

Albany, N. Y., *June* 21, 1907.

Mr. J. S. Hanlon, *City Clerk, Auburn, N. Y.:*

Dear Sir:— Replying to your letter of April 30, acknowledged by me under date of May 2, I beg to state that our Consulting Engineer has examined the plans referred to him, but I desire to recall to your mind the fact that at various times heretofore I have called your attention to the necessity of improving the condition of the Owasco outlet and holding back the organic solids which now come from the sewers in such quantity and thereby pollute that stream.

I have intimated to you more and more pointedly the purpose of the State Department of Health to do away with this pollution, and I now beg to outline to you the policy which it is the purpose of this Department to pursue in the future, to the end that all future pollution may be prevented and present pollution ultimately eliminated.

In order to determine the nature and amount of this pollution and to study the effect which it has had upon the health of the municipalities situated along the river, a comprehensive sanitary investigation of the entire watershed was recently undertaken by the Sanitary Engineering Division of this Department. This investigation covered a field examination of the principal sources of pollution, and included a statistical detailed summary of the population residing upon the drainage area of the Oswego river and its main tributaries, the population contributing sewage to these streams, the principal sources of manufacturing and industrial pollution, the relation of the volume of sewage pollution to stream flow, and the effects which this pollution has in the creating of general and local nuisances and upon the public health of persons or communities residing on or near the banks of these streams.

The work of the investigation is now completed, and the report which has been submitted to me clearly indicates that, if the public health of this section of the State is to be conserved, aggressive action must be taken at once not only to prevent the further discharge of untreated sewage into the waters of the Oswego river, but to eliminate the present sewage now being unlawfully discharged by many municipalities into these waters. The health of many municipalities has already suffered from the effects of the domestic and other wastes discharged into these waters, and unless this pollution is checked commensurate with the increasing population of the district, these deleterious effects will continue to be a menace to these communities.

To the end, then, that these dangers may be eliminated and that the waters of the Oswego river may, as far as is practicable, be returned in their original purity, this Department will hereafter require that no sewage shall be discharged into any of the waters of the Oswego river without preliminary treatment. This requirement of preliminary treatment is in accordance with section 75 of the Public Health Law. The degree of purification required by this Department will depend upon local and other conditions effecting the public health and comfort of residents who dwell in the vicinity of these streams or receive their water supplies from them, but will, in general, be as follows:

(1) In the case of persons, corporations or municipalities situated on lakes of the Oswego watershed not used for public water supplies, no sewage shall be allowed to enter such lakes without being first purified to such a degree that all solid and suspended matter will be removed, and that no odors or other offense shall be created in the vicinity of the points of sewage discharge.

(2) In the case of persons, corporations or municipalities situated upon the Oswego river and the main branches which form outlets to the lakes of the Oswego watershed, and upon all lakes used as a source of public water supply, no sewage shall be allowed to enter such waters without being first treated by a complete process of purification, the effluent from which shall at all times be free from all suspended matter and any dissolved or other organic matter that may undergo subsequent putrefaction.

The above outline of the general policy of the Department is offered as a guide to local authorities of municipalities, owners of manufacturing or industrial establishments, and private individuals, having at present or in contemplation public or private sewerage systems that may drain into any of the waters of the Oswego river, and to indicate to them, in a general way, the conditions upon which plans for such systems will be approved and permits for the discharge of the sewage thereof issued. It is expected that local conditions may alter these requirements with respect to the manner of sewage discharge, and to the degree of purity of the effluent from the sewage disposal works. It is also expected that with the future growth of population upon the watershed and the resulting increase of sewage that will have to be cared for, the requirements for more complete methods of disposal and for greater purity of effluents may be demanded.

I beg therefore to call your attention to article V of the Public Health Law, which provides for the protection of public water supplies and the prevention of pollution of the streams of the State, and to ask your co-operation in the enforcement of these provisions, to the end that the cities and villages situated in the Oswego river basin may be protected against the existing and increasing dangers of sewage pollution of these waters.

In view of the policy outlined above, and in view of the fact that this Department has repeatedly advised you of the probable policy of the Department, I am unable to approve the plans submitted for the Swift street sewer, and will be unable to approve any further plans for sewers in the city of Auburn until there is presented to me some definite and tangible evidence of the good intention of the city of Auburn in the matter of purification of the city sewage.

Respectfully yours,

EUGENE H. PORTER,

Commissioner of Health

AUBURN, N. Y., *June* 22, 1907.

DR. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Replying to your letter of the 21st inst. relative to approval of sewer plans submitted to you, I beg to state that the sewer discharging into Hunter brook has not as yet been taken therefrom because the disposal plants have not been constructed.

I beg to call your attention, Dr. Porter, to the fact that recently definite steps have been taken which will mean the construction of two sewage disposal plants, one for the sewage of that part of the city known as the fourth, fifth, sixth and seventh wards' sewer district and one for the first, sixth and tenth wards' sewer district, which last named district includes the sewer emptying into Hunter brook.

At a meeting held May 21, 1907, the common council did by resolution unanimously determine "to construct sewage disposal plants for the fourth, fifth, sixth and seventh wards' sewer district, and first, sixth and tenth wards' sewer district (for the purpose of disposing of the sewage of these sections of the city), at the expense of the city at large." Another resolution unanimously adopted at the same meeting reads "That it is hereby determined in the event of the city's building such sewage disposal plant, to construct the sewer for the fourth, fifth, sixth and seventh wards' sewer district according to the plans and specifications approved and adopted by this body, February 6, 1906."

At a meeting held May 23, 1907, another resolution was unanimously adopted which reads as follows:

"Resolved, That the city engineer be and he is hereby directed to complete the plans and specifications for sewers for the entire area of the first, sixth and tenth wards' sewer district, which shall comprise a trunk line or an interceptor, as the situation may require, and further

"Resolved, That he is directed to make *complete* plans and specifications for a disposal works on the plan of a septic tank, and filtration beds if necessary, sufficient to care for *all* of the sewage which may or can be collected within the entire area of the first, sixth and tenth wards' sewer district."

At a meeting held June 4, 1907, upon recommendation from the board of estimate and control, the common council did designate June 11, 1907, as the time for a public hearing on the proposition to issue bonds in an amount not exceeding $30,000 "for the purpose of constructing a sewage disposal plant for the fourth, fifth, sixth and seventh wards' sewer district according to the plans heretofore adopted," and also at the same meeting was passed the following:

"Whereas, the common council has determined to build the fourth, fifth, sixth and seventh wards' sewer system according to the plans adopted and certain sewers in the first, sixth and tenth wards' sewer district and also sewage disposal plants in said district, it is

"Moved, That the president appoint a special committee of the aldermen who, with the city attorney, shall investigate and report as to the necessary rights of way to be acquired for such sewers and as to the various sites suitable for such disposal plants in said districts, and they be empowered to obtain necessary options on rights of way and necessary land for such improvement and report back to the council." The committee was then appointed by the president.

At a meeting of June 11, 1907, the public hearing on the proposition to issue bonds ($30,000) for construction of disposal plant was held and, no one appearing in oposition, the council did unanimously adopt a resolution authorizing the mayor and city clerk to issue said bonds " upon the determination of the aggregate cost of said disposal plant upon its completion."

I ask you, Dr. Porter, if all these aforementioned unanimous actions of the council do not indicate definite and tangible evidence of the good intention of the city of Auburn as regards sewage purification?

At no time, as regards the common council, has there been any question of the advisability or necessity of disposal plants, but there has been some difference of opinion as to whether the cost of same should be paid by the property owners of the sewer districts or by the general city expense. This difference of opinion has now been settled and the council is unanimously working with an idea of hastening the construction of needed sewers and disposal plants.

In view of actions of the council as previously stated, I would be greatly pleased if you would advise me whether or not it would change your action on the Swift street sewer, which is a comparatively small one and would empty into a large trunk sewer at present constructed.

Kindly reply at your earliest convenience, and oblige

Very respectfully yours,

J. S. HANLON,
City Clerk

ALBANY, N. Y., *June* 26, 1907.

MR. J. S. HANLON, *City Clerk, Auburn, N. Y.:*

DEAR SIR: — I am in receipt of your letter of the 22d instant, and am very much gratified to learn of the attitude of the common council of Auburn toward the construction of sewage disposal plants. You will doubtless appreciate the fact that I have no way of obtaining information as to the progress of the different cities of the State except as the city clerks or other officials are kind enough to notify me, which perhaps accounts for my ignorance in the matter of progress which your city is making.

My understanding of the conditions at Auburn is as follows, and I shall be glad to have you advise me if my understanding is correct.

Plans for the sewage disposal plant for the fourth, fifth, sixth and seventh wards' sewer district were approved and adopted by your council February 6, 1906, being approved by this Department late in 1905. You have recently authorized a bond issue for the construction of the same according to these plans, and are ready to proceed except for rights of way and other minor matters. This district does not drain into Owasco outlet, but rather to the north, and the construction of such a plant does not at all improve conditions in that much polluted stream.

We have no record of having approved plans for a disposal plant for the first, sixth and tenth wards, and if such plans have been made, I have no knowledge of it. This drainage area also, I understand, is outside the Owasco drainage area, and the disposal plant is intended to prevent pollution of a small stream.

Practically since 1905 no construction has been entered in, and the two disposal plants planned do not affect the conditions existing in the Owasco outlet. I understand that the ninth ward sewer is so constructed that it might receive the sewage from the Swift street sewer, and that the ninth ward sewer might be carried to the site where a disposal plant for the whole city would have to be built, thus easily incorporated into the general scheme which is inevitable.

If you could see your way to preparing plans for the disposal of the ninth ward sewage and could discharge the Swift street sewer into the ninth ward sewer, provided these two things are possible, I should be glad to approve the construction of the Swift street sewer.

Very respectfully yours,

EUGENE H. PORTER,
Commissioner of Health

AUBURN, N. Y., *June* 28, 1907.

MR. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — Replying to your letter of June 26th, I call your attention to the fact that the plans for the disposal plant for the first, sixth and tenth wards have not as yet been completed and therefore, of course, have not been submitted to you. In my former letter to you, you will notice one of the last resolutions adopted by the council directed the city engineer to complete plans for the sewage system and the disposal plant.

Mayor Aiken has requested me to call your attention to the fact that if the proposed sewer in Swift street should be constructed as you recommend, so as to connect with the ninth ward sewer, the cost of construction would be enormous in comparison with the benefit derived by the property owners directly concerned. You stated that you would approve the construction of the Swift street sewer provided it should connect with the ninth ward sewer, with the idea of the construction of a disposal plant. I do not believe, Dr. Porter, that the project of the ninth ward disposal plant can possibly be considered for some time to come, inasmuch as I stated in my former letter we are already making every possible haste to construct one in the first, sixth and tenth wards' district, and one in the fourth, fifth, sixth and seventh wards' sewer district. Undoubtedly after these two have been completed others will certainly follow, and taking these facts into consideration, Mayor Aiken has requested me to ask if it would have any effect upon your approval of the Swift street sewer, as he is of the opinion that the city of Auburn is giving positive evidence that they intend to construct sewage disposal plants, but the matter must be taken up step by step in order not to saddle too heavy a burden upon the taxpayers at one time.

I would deem it a favor if you would consider these points to which I have referred before Tuesday, July 2, as that is the day of the next regular meeting of the common council and I could then inform them of your decision.

Very respectfully yours,

J. S. HANLON,
City Clerk

On July 11, 1907, application was made for approval of a plan for a sewer in Seward avenue in the first, sixth and tenth wards' sewer district.

On July 16, the plans for sewers in Swift street and Seward avenue were approved and the following permits were issued:

PERMIT

Application having been duly made as provided by section 76 of the Public Health Law as amended by chapter 468 of the Laws of 1903, permission is hereby given to the common council of Auburn to discharge sewage from the Swift street sewer into the second ward sewer at Auburn within the municipality of Auburn, in accordance with the plans accompanying the petition, under the following conditions:

1. This permit is issued for a period of two years from the date hereof.

2. This permit shall be revocable at any time by the State Commissioner of Health, or subject to modification or change if in the judgment of the said Commissioner it shall become necessary or desirable; and the granting of this permit shall not be deemed to effect in any way action by this Department on any future applications that may be made for permission to allow the discharge of additional sewage into the waters of this State.

A. H. SEYMOUR,
Acting State Commissioner of Health

ALBANY, N. Y., *July* 16, 1907.

NOTE.— This permit to become operative must first be recorded in the county clerk's office of Cayuga county, in which the outlet of the sewer, or in which the establishment is located.

AVON

A plan for a sewer extension in South Genesee street in the village of Avon was submitted for approval on November 16th and approved on December 23, 1907.

The report of the chief engineer and a communication to the village follow:

ALBANY, N. Y., *December* 11, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — I beg to report on my examination of a plan for the extension of the South Genesee street sewer in the village of Avon, Livingston county, which was submitted on November 16th for approval by the sewer commissioners through Monroe D. Baker, engineer for the village.

The plans show an eight inch extension to the present system, original plans for which system were approved December 4, 1894. The sewer proposed is of adequate grade and capacity, and the plan appears satisfactory.

It is evident that subsequent to the approval of the original plan for sewers, extensions have been made to the system, so that the maps of the sewer system on file in this office is not complete. The present application states that "the sewer system, installed several years ago, is in good working order, but will need extensions from time to time to meet the requirements of new buildings, as the plans adopted at the time of the installation of the plant do not cover the entire corporation." No report and map has been filed with this Department in accordance with the provisions of chapter 468 of the Laws of 1903, showing the sewer system of the village as it existed on May 7, 1903.

It is desirable, if not necessary, that a complete map of the sewer system of the village should be on file in this Department before plans for extensions are examined or approved.

With respect to applications for future extensions, therefore, I should recommend that before approval is given to such extensions, it be required by this Department that a report and a map of the sewer system be submitted by the sewer commissioners as required by chapter 468 of the Laws of 1903. Such map should show all sewers constructed to date, those not shown on the original plan being marked with the year showing the date of their construction. The map should show the entire area of the village, with all streets and proposed streets, in order that proper consideration may be given applications for future extensions to the system.

The map should show: Contours at intervals of five feet; elevations of invert of sewers; size of pipes; gradient of sewers; direction of flow; location of manholes, flush tanks, etc.; and should be on a scale not smaller than 200 feet to an inch. With such map on file, future applications for approval of extensions to the sewer system may be readily taken up.

In a recent report on the sanitary inspection of the Genesee watershed prepared by Prof. H. N. Ogden, assistant sanitary engineer of this Department, it is recommended that Avon, among other places, should be induced to take some steps toward sewage purification.

In view of the relative importance of the extension proposed, of the expressed desire of the village sewer commissioners to construct the sewer during the present season, and, since the plan for the extension appears entirely satisfactory, I should recommend that the plan be approved and a permit for discharge of sewage be issued conditional upon the submission of the report and map required by chapter 468 of the Laws of 1903 within one year from the date of the permit, and further conditional upon the submission within one year from the date of the permit of complete plans for sewage disposal, at which time the question of requiring the construction of any or all of the proposed works will be considered.

I have prepared a permit in accordance with above suggestions for your approval.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *December* 23, 1907.

Board of Sewer Commissioners, Avon, N. Y.:

GENTLEMEN: — In the matter of plans for sewer extension on South Geneseo street in the village of Avon, which were on November 16th submitted to this Department for approval, I beg to state that I concur in the recommendation embodied in the report of the engineer of the Department, a copy of which is enclosed, and have therefore approved the plan and issued a permit under the conditions suggested in said report.

You will note that such permit, to become operative, must first be recorded in the county clerk's office of Livingston county.

I am enclosing a report blank, which, under the conditions of the permit, you are to return to this Department, accompanied by a map of the sewer system, within one year from the date of the permit.

I am returning approved plan under separate cover.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

BEDFORD

MONTEFIORE HOME

On April 13, 1907, two preliminary plans for sewage disposal were submitted for approval.

ALBANY, N. Y., *April* 17, 1907.

MR. JULIUS ROBERTSON, *Montefiore Home, Broadway and* 138*th Street, New York City:*

DEAR SIR: — I have your communication of April 13th, together with two plans pertaining to a new sewage purification and disposal plant to be installed at your sanitarium.

These plans were taken up at once and have been carefully examined by one of our engineers as to the general suitability of the two outlines shown.

Recommendations as to the final approval of either plan when submitted in proper form can not be definitely made at this time owing to the lack of data with respect to such points as to the number of persons to be provided for, the average quantity of sewage to be expected from each person per day, character of the soil at the filtration field (in the case of the Webster plan), the capacity of the plant as to time of detention in septic tank, and rate of operation of filter beds (in the case of the Dittler sewage disposal plan.)

It is expected, of course, that such complete data will be embodied in a report to accompany the plans when finally submitted to the Department for approval. As to the general features of each plan, it is probable that either plan is worthy of final approval provided that the plans and the usual detailed description as to the capacity of the plant, expected contribution of sewage or detention in septic tank and rate of operation of filters (and in the case of the Webster plan, the character of the soil in the filtration fields, etc.) proves satisfactory when the plans and report accompanying the same are finally submitted. The completed plans should be worked out in detail, giving dimensions of the different structures, method of operation of works, etc. .

These requirements are those always asked for when plans are submitted to this Department for approval, and are necessary in order to enable our engineers to pass intelligently upon them.

In submitting plans for final approval, send the report of the engineer and duplicate plans so that one set of the plans can be filed here and the other set with the approval attached will be returned at once. I cannot urge upon you too strongly the necessity of giving this matter your prompt attention. The situation is one which is apt to call forth radical action unless immediate steps are taken, and I would urge that you submit the plans for approval to this Department at the earliest possible opportunity. They will be passed upon immediately and you will be advised as to the result without any delay.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

NEW YORK, *April* 27, 1907.

HON. EUGENE H. PORTER, M.D., *Commissioner State Department of Health, Capitol, Albany, N. Y.:*

DEAR SIR: — Being desirous to comply to the best of your Department's satisfaction with contents of your favor of 17th inst.

I engaged Messrs. Hering & Fuller of this city to prepare and promptly submit to you the plans and detailed descriptions which your above mentioned communication asks for.

I trust your Department will promptly approve of those plans and await your kind and early advice to that effect. Messrs. Hering & Fuller will then attend to the prompt installation of the plant in accordance with their plans.

Very respectfully yours,

JULIUS ROBERTSON,

Chairman Committee on Country Sanitarium

ALBANY, N. Y., *May* 1, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — In regard to the plans for a sewage disposal plant for the Montefiore Home which were received April 30th, and application for the approval of which was received from the trustees of the Home, Bedford, Westchester county, I beg to report as follows:

The plans show sewage purification works in very complete detail. The plant consists of a septic tank followed by sprinkling filters with supplementary treatment, first, by proposed new broad irrigation trenches and, finally, by secondary broad irrigation trenches, the latter forming a part of the present system.

I have carefully examined these plans and found them complete in every detail, both as to engineering features and method of treatment.

I therefore beg to recommend herewith their immediate approval.

Very respectfully,

THEODORE HORTON,

Consulting Engineer

The plans were approved on May 9, 1907, and a permit issued.

BINGHAMTON

Plans for sewer construction were approved during 1907 and permits were issued, under certain conditions, for the discharge of sewage from sewers in the following streets in the city of Binghamton:

Mill street, Euclid avenue, Bigelow street, Fourth Ward system, Chapin street, Bennett avenue, Beethoven street, Davis street, Jarvis street, Prospect street and Clarence street.

In connection with the consideration of the plans for the Fourth Ward system, a careful study of the problem involved — the pollution of the Susquehanna river — was made, including a sanitary survey of the entire Susquehanna watershed in New York State.

The report of the Chief Engineer and the permit issued are given below.

ALBANY, N. Y., *March* 25, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.*:

DEAR SIR: — An application for the approval of plans for a trunk sewer outfall for the removal of storm water and sewage from the Fourth ward of the city of Binghamton was received by the Department in January, 1907, together with profiles, details and all requisite duplicate plans. Upon request, there was later received specifications and a report of the Engineer describing the engineering and constructive features of the project.

Many circumstances make the consideration and examination of these plans and application an important one, and at your request I have made a careful study of them, not only as a local engineering problem, but in relation to the broader and more general question of the pollution of the Susquehanna river and its tributaries. I accordingly beg to submit the following report in the matter with the conclusions and recommendations that I have reached.

The city of Binghamton is situated in Broome county at the point of confluence of the Chenango and Susquehanna rivers.

These two rivers flow through the city in a manner to divide it naturally into three distinct areas; one lying between the two rivers, one lying on the right banks of the Chenango and Susquehanna rivers, and one lying on the left bank of the Susquehanna river. The topography of the first area is relatively lower and uniformly flat, while the remaining two areas are much more elevated, with rather precipitous slopes reaching toward the river banks.

A general system of sewerage was designed about 25 years ago — in 1882 — by Rudolph Hering for the needs of the city within limits then established. This system was designed upon the combined plan and has been constructed in general accordance with them. The general growth and development of the city, as well as extension of city limits, has resulted in an overtaxing of the system in some portions of the city, but in general the system well meets the requirements for sewerage at the present time, and with occasional enlargements and modifications should amply provide for sewerage facilities for the city for many years to come.

The section of the city now comprising the Fourth ward was not sufficiently developed at the time the original plans were prepared to be included in those plans. The rapid development of this section in recent years, however, and the isolated character of it topographically, has resulted in the necessity for a complete and independent system of sewers for this ward. These plans, which are now before the Department for approval, show a main outfall trunk sewer leading from a central portion in the ward, more particularly at a point on Helen street between Grove and Terrill streets, in an easterly and then southerly direction to the Susquehanna river, with an outlet into the river just west of the present Driving Park. This sewer is designed for the combined relief of storm water and sewage of the Fourth ward, but the fact that no laterals are shown to serve the houses on this area, indicates that the main purpose of the sewer, at least for the present time, is for the purpose of drainage of swamp land and relief of storm water.

During a visit to Binghamton on February 12, 13 and 14, 1907, I conferred with the city engineer, the mayor, and others interested in the Fourth ward project, and personally inspected the locality and the route of the outfall sewer shown on the plans submitted. I also studied other routes, which were referred to in the report of Mr. H. N. Ogden and plans of which were on file in the office of the city engineer, with a possible view of recommending some other route than the one shown upon the plans now before the Department, and one that might be more consistent with the requirements or conditions upon which the approval of plans, or a permit, might be granted by the Department.

Topographically, the general character of the Fourth ward is a plateau at an elevation of approximately sixty feet above the water level of the Susquehanna river. A ridge running generally parallel with Riverside Drive and the Susquehanna river so divides the ward as to form a drainage basin north of this divide, from which the natural flow is to the westward toward the village of Lestershire. The general slope is so flat, however, that the drainage of this basin may be collected artificially and carried in almost any direction.

In view of these topographical features it will be easily understood that plans for a number of routes for an outfall sewer to drain this territory are very possible of development, and in fact already have been suggested and planned. Considered generally and omitting slight modifications, the more feasible of these routes may be described as follows:

1. Starting at a point on Helen street, between Grove and Terrill streets and running easterly and southerly to the Susquehanna river, with discharge into the Susquehanna river just west of Driving Park, approximately on line of Helen street extended.

2. Starting on Helen street, between Grove and Terrill streets, and running generally westerly along low ground and small streams to Margaret street (city line), and then turning southerly, down Margaret street by means of a tunnel crossing Riverside Drive to the Susquehanna river, on line of Margaret street extended.

3. Starting on Helen street, as before, and following line described under (2) to Margaret street, and then continuing either in a southwesterly direction through the town of Union to the Susquehanna river; or in a northwesterly direction, through the

village of Lestershire to the Susquehanna river; or in a northerly and easterly direction to Trout brook.

Each of these routes has advantages and disadvantages depending upon the relative cost, extent of area that can be drained, proximity to population or dwellings from which sewage is to be received, proximity to open streams or the Susquehanna river into which storm water might be discharged and the facility with which domestic sewage can in the future be collected and led to a favorable site for purification when this may be required.

Considering the advantages and disadvantages of each of these three general routes separately, we may say that:

1. The Driving Park route has the advantage of least cost, as estimated by the engineers. It has the disadvantage of not being able to drain a small section of the ward west of West End avenue, unless the general level of the small area is raised by filling it in. Again it has the advantage of being the shorter route to the Susquehanna river or any other stream, which, again, is offset by the fact that the point of discharge is less remote from the residential section along Riverside Drive than with the other routes. Finally this route passes more remotely from the greater portion of the houses now built in this ward, so that in early years of use this route will not be so serviceable for sewage as the other routes.

2. The tunnel route has the disadvantage of costing, according to engineers' estimates, more than the Driving Park route. It has, however, the advantage of the possibility of serving the entire area without any filling in of land, although with the upper terminus at Helen street it will not serve, except by means of an earth channel, the low depression at the westerly end of the drainage basin. It has the advantage of serving as soon as constructed by means of relatively short laterals, the built-up section in northwesterly part of the ward; but will not serve without long laterals the less built up, but more rapidly growing section in the easterly part of the ward. This route is slightly longer than the Driving Park route but the point of discharge is more favorably located for the temporary discharge of sewage, owing to its remoteness from residences now, or later to be built, along Riverside Drive.

3. The third route to the westward or northward has the advantage of following the natural drainage of the district. This, however, could, from a financial point of view, only be of advantage to the city in case the land west of the city line should in the future become a part of the city and its improvement now be a consideration. Although this is a matter for serious consideration if future growth of the city should extend beyond the present limits, it is evident that a sewer now built through this district would be of no especial benefit to the Fourth ward. Again, such a route would be longer than the others and if the question of storm drainage is more important than sanitary sewerage, the cost would be much greater than the other routes. If, however, the question of sewerage is paramount, such a route might not only be cheaper but much more desirable in its relation to a suitable site for disposal plant. Again, if sewerage (*i. e.*, on the separate plan) only were adopted at this time the same question as now exists with respect to drainage would ultimately have to be met and at approximately the same cost.

I was informed that the condition for present bond issue requires an outfall sewer within the ward limits. Such a limitation, if true, might preclude the selection of any route to the westward outside of present city limits, or, if not, it might result in a reconsideration of the whole project and possibly call for a new vote of the citizens upon a new bond issue.

After carefully considering the advantages and disadvantages of these three general routes, involving many and complex factors of engineering, of cost and of sanitary benefits to be derived, I am led to conclude:

1. That there is practically little or no choice between the Driving Park and the tunnel route.

2. That the route of an outfall sewer leading outside of the city limits to the westward, though presenting the most favorable possibilities, provided the city will ultimately own the land west of the city line, is, however, attended with uncertainties as to cost and with uncertainties as to extension of city limits to the westward in the future.

3. That since no plan considering any territory or route outside the limits of the city has yet been presented to the Depart-

ment it is unnecessary and perhaps irrelevant to enter into a discussion of the merits of such a route at this time.

Accepting the route as shown upon the plans now before the Department to be, from an engineering standpoint, a practicable one, and equally satisfactory as the tunnel route, there then remains to be considered the questions of the hydraulic and constructive features of the design and the more strictly sanitary questions of the propriety of discharging the raw sewage of this district into the Susquehanna river with or without adequate provision for present or future sewage disposal.

With respect to the design of the outfall sewer, I have carefully examined the plans and details and read the accompanying reports of the engineers with respect to them. I find that with respect to capacity this outfall is designed to satisfactorily receive rain water at the rate of about two inches per hour when the district will be fairly well built up. For a great many years it will remove rain water at a greater rate than this, owing to the lower relative amount and rapidity with which it will reach the sewer. When this district becomes densely populated like the central portion of the city, with relatively larger areas of impervious streets and roofs, this sewer will take care of successively less and less rates of rainfall, and may ultimately have to be relieved as is now being done at present in parts of the city. For a great many years to come, however, this sewer should satisfactorily serve the drainage requirements of the Fourth ward. The alignment, grades and other hydraulic factors of this outfall sewer, as well as details of sections and other structural elements, are, in general, with the limitations above stated, satisfactory.

The route of the 18-inch sanitary sewer beneath the open channel overflow sewer south of Riverside Drive, however, should be somewhat modified. It is now shown as running diagonally across private land to a point some three hundred (300) feet west of the point where it leaves Riverside Drive, where the more natural and direct course would be in a southerly direction nearly at right angles with Riverside Drive and should cross the small island or peninsula to a point of discharge into the main channel of the river. The river currents at the latter point would also be more favorable to dispersion than at the present proposed point of discharge. In either case, however, sanitary discharge sewers should be carried out into the river to the channel with the outlet submerged at low-water stage.

The necessity for ultimate purification of the sewage of Binghamton cannot be questioned. This requirement is forecasted not only by the steadily growing demands of the people for protection of our streams — demands that are being reflected by the increased authority with which our State Departments of Health are yearly being clothed — but also by the growing necessity for immunity against local nuisances within the limits of the city itself. These nuisances have already begun to give trouble and offense to citizens residing along the river banks, especially along the Chenango river. How long in the future before a general purification of sewage should be required, and whether a temporary disposal of the Fourth ward sewage into the Susquehanna river for a limited lime in the future should be permitted, will depend upon the general growth of population of Binghamton and the municipalities above and below her on the Susquehanna river, and especially to the successful effort made by Binghamton in improving the methods of discharging her sewage from present and future sewer outlets.

The present sewer outlets discharge at or very near the river banks where the depths are shallow and the velocities slight. The sewage thus discharged is kept concentrated, and in its flow down the river has a strong tendency to hug the shore and admit of deposits of smaller suspended matter and stranding of larger suspended matters along the shores or banks of the river. These discharge sewers should be carried out into the stream with the outlet submerged in the channel of the river. Here the currents are swifter and the dispersion of the sewage greater. The suspended matters, both large and small, would thus be kept in the flowing channel and not be carried to and along the banks of the stream where they could decompose and produce the nuisances that will continue to exist and increase at certain seasons. The introduction of these improvements with all outfall sewers, supplemented, as may be necessary, by fine screening to further reduce a considerable proportion of total suspended matters and practically all visual suspended matter, will, in my opinion, have an appreciable influence in postponing the time when ultimate sewage treatment will be required or demanded.

If, as is evident, sewage disposal is to be ultimately required for the sewage of the entire city, it is highly desirable, if not necessary, to keep the sewage separated from the water that collects during storms or as natural drainage from the land whenever this is possible. If this separation is to be secured in the future in the Fourth ward, it is necessary that all lateral sewers, which may be constructed now or in the future, to receive domestic sewage, whether or not they be allowed to discharge temporarily into the proposed trunk sewer, should be sanitary sewers. They should be designed with sizes and grades that will admit of their being intercepted by a sanitary trunk sewer to be provided in the future, and to be led to a disposal plant located at some favorable point below the city. Such a sanitary trunk sewer would then only have to be of moderate size compared with the present storm outfall sewer. Its route would more naturally be along the route of natural drainage for this section, *i. e.* to the westward. When the time comes for its construction, it could also provide for any additional territory, west of the present city line, that may be added to the city in the future.

The question of the temporary discharge of these lateral sewers into the proposed trunk sewer, as well as the continuance of discharge of sewage from other sewers of Binghamton into the Susquehanna river can, however, only be decided after a careful study of the extent of pollution of this river and its tributaries and the effect of this pollution upon the purity of its waters. In order to secure this information a sanitary reconnaissance was made of the Susquehanna river watershed by the Sanitary Engineering Division. This reconnaissance included a statistical investigation of the population residing upon the drainage area of the Susquehanna river and its main tributaries in both the State of New York and Pennsylvania; the population which contributes raw sewage to the river and its main tributaries in the State of New York; and the principal sources of pollution of the river and its tributaries from manufacturing or industrial sewage in the State of New York.

It was hoped and anticipated that similar pollution statistics could be secured from the drainage basin of the Susquehanna river in Pennsylvania, but unfortunately these statistics have not at this time been collected by the Pennsylvania State Department of Health and consequently could not be obtained. I was officially informed, however, that during the coming season an investigation of the sanitary conditions of this watershed, similar to the one just completed by this Department will be undertaken by the Pennsylvania State Department of Health and probably be completed before the end of the year.

Since a comprehensive investigation and report of the sanitary conditions of the entire Susquehanna river basin, covering both States, cannot at this time be completed, I have at your direction, carried out an investigation and study only with reference to the portion of the drainage area within New York State and limited it to a consideration of such factors as are essential to a consideration only of the question of the Binghamton sewage.

The drainage area of the Susquehanna river watershed at Binghamton below the conflux of the Chenango and Susquehanna rivers is 3,980 miles, 1,580 miles of which is tributary to the Chenango river and 2,400 miles to the Susquehanna river proper.

The low summer flow of the combined streams for a period of one month is, according to the records of the United States Geological Survey, about 900 cubic feet per second. During shorter periods, of, say, one week, of extreme low water the volume will, according to the same records, not exceed 400 cubic feet per second.

The population upon the combined area of the two rivers below Binghamton is about 206,000, of which about 78,000 resides upon the watershed of the Chenango above Binghamton and 88,000 upon the watershed of the Susquehanna river above Binghamton. These populations give a resident population per square mile upon the combined area of the two rivers of 52. Upon the Chenango the population is 49 per square mile while upon the Susquehanna river the population is 36 per square mile.

Of the resident population upon these river basins, a large majority do not discharge sewage directly into the streams. That is, they are provided with vaults, cesspools and other means of disposal of sewage whereby it is not discharged directly into these waters but percolates through the soil as to be practically or wholly purified. A large portion of the population does, however, discharge its sewage directly into these waters by means of sewer systems, private drains or by privy vaults and cesspools located directly on the banks or over the streams.

The estimated population that discharges sewage directly into and thus contaminates directly the tributaries of the two rivers below Binghamton is 75,000, of which 11,000 discharge into the Chenango river above Binghamton and 19,000 discharge into the Susquehanna river above Binghamton. This is equivalent to a direct pollution for a population of 19 persons per square mile for both rivers; 6½ population per square mile for the Chenango and 8 population per square mile for the Susquehanna river.

It will be seen from the above figures that, whereas on the basis of total population per square mile there is no striking contrast between the densities of total population per square mile on the two branches above Binghamton and the main river below Binghamton, there is a marked contrast in the relative populations that discharge sewage directly into the river at the three points mentioned. The pollution of the river measured by this latter standard, below Binghamton, is approximately three times that of the Chenango just above Binghamton, and about two and a half times that of the Susquehanna river just above Binghamton. In other words, the discharge of the raw sewage of Binghamton into the Susquehanna increases the pollution of the river from two and a half to three fold.

The volume of flow of both the Susquehanna river and the Chenango river are quite variable. During floods the volume is relatively very great, while during very dry summer seasons the volume is correspondingly small. Over a series of years the average summer flow is well maintained and ample to dilute the sewage of Binghamton and the municipalities above her on the watershed, sufficiently so that no nuisances other than the local ones will occur. There are periods as previously stated when the combined flow of the two rivers is only 900 cubic feet per second for a period of one month, and 400 cubic feet per second for a period of say one week.

With a population of 75,000 persons contributing raw sewage above this point of the river, we have, on a basis of minimum flow, a dilution of only 5½ cubic feet per second for 1,000 persons.

With the population of, say 40,000 persons discharging raw sewage from Binghamton alone, we have on the same basis of flow, a dilution of 10 cubic feet per second for 1,000 persons. This flow of the river at these times, though sufficient to prevent nuisances if the sewage be discharged in a manner to produce thorough dispersion, it is not in my opinion sufficient to prevent local nuisances with the sewage discharged through outlets as at present constructed in the city.

The Susquehanna river below Binghamton is used as a source of water supplies by a number of municipalities. Athens and Sayre are the first and principal ones, located some forty miles below. Others such as Tonawanda, Tunkhannock and some ten municipalities supplied by the Spring Brook Water Supply Company of Wilkes-Barre take their supply from the river at certain seasons of the year.

It is safe to say that no municipalities should now use the Susquehanna river as a source of supply without preliminary purification. Sayre and Athens are provided with filter plants. The others above mentioned, however, are not at this time provided with municipal filters, but use the raw river water at certain dry seasons of the year.

In order to protect the water supplies and general health of these municipalities, it is necessary that the Susquehanna river as with other rivers of the State, be kept in as pure a condition as is practicably possible. Many of these municipalities, especially the smaller, cannot by any means afford purification plants. Again there are times when through accident or otherwise, a filter plant may be put temporarily out of service. Finally there are some communities situated only a short distance below sewer outlets of other municipalities, which although they may take their water supply from other sources than the river, are subject to the general insanitary influence and possibly nuisances arising from such sewer outlets.

From the foregoing statement of facts and opinions with respect to the pollution of the Susquehanna river by the city of Binghamton, I will briefly conclude:

1. That the sewage pollution of the Susquehanna and the

Chenango river above Binghamton by the various municipalities situated along their courses, although insufficient at the present time to affect in a materially dangerous degree the general quality of the river or to produce at times local nuisances of a serious nature, should, on account of the growth of population upon these watersheds, be restricted at the earliest possible time. Considering the distance of the points of pollution above Binghamton and the relative dilution, there is at the present time a minimum danger to the filtered water supply of Binghamton if the filter plant is operated at the highest practicable degree of efficiency.

2. That the amount of sewage which is daily being poured into these rivers by the city increases the total pollution from two and a half to three fold. This pollution, even with the most advantageous arrangement of outfalls is fast approaching the limit of diluting and digestive capacity of these rivers. It is well known that local nuisances occur at times along the shores of these rivers, especially during low flow, and that these moreover are worse along the Chenango than along the Susquehanna river. The pollution has reached the point when a purification of the entire sewage of the city must soon be introduced, not only for the protection of the citizens of Binghamton but those municipalities situated below her along the river.

3. That if better arrangements for discharging the sewage into the main channels of these rivers are introduced by properly extending all outfall sewers, supplemented if necessary by fine screen, these local nuisances can be temporarily avoided.

4. That although there are municipalities situated on the Susquehanna river below Binghamton within a distance of fifty miles, that use the water of this river for a public supply, no municipalities within a hundred miles use the river water without preliminary filtration. Notwithstanding this, however, and the fact that the river receives a number of large tributaries the waters of which are relatively much purer than the Susquehanna, there may be danger, at times, if these filter plants are not properly and efficiently operated.

5. That in view of the ultimate requirement for sewage purification it is essential:

(*a*) That methods for collecting the sewage of the entire city by means of a system of intercepting sewers and for a purification of the sewage thus collected should be studied without delay and plans to this end prepared and submitted for approval to the State Department of Health at an early date.

(*b*) That in all present and future construction of sewers upon grounds of economy and efficiency in sewage disposal all domestic sewage be collected in sanitary sewers so designed as to be readily intercepted and led to future purification works.

6. That in order to secure the greatest dilution, dispersion and digestion of the sewage after discharge into the river it is essential that all discharge sewers be carried out into the main channel of the river with the outlets submerged at low-water stage.

In view of these conclusions and with special reference to the proposed plans for the Fourth ward outfall sewer, I beg to recommend that the plans be approved and a permit be issued for the discharge of any sewage therefrom into the waters of the Susquehanna river under the following conditions:

1. That the permit be issued for a period of not more than three years subject to renewal at the discretion of the Commissioner of Health and provided that all of the conditions of this permit shall be complied with.

2. That within three years plans for a system of intercepting sewers to collect the sewage of the entire city together with plans for a disposal plant located at some favorable point below the city, be presented to the State Commissioner of Health for approval.

3. That all domestic or manufacturing sewage of the Fourth ward that is now or may become tributary to this outfall sewer, be collected in separate sanitary sewers, so designed that they may be later intercepted by a sanitary intercepting sewer leading to the future disposal works as provided under condition (3).

4. That the 18″ sanitary sewer beneath the proposed open outfall channel be carried out into the main channel of the river with its outlet submerged at low-water stage.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

PERMIT

Application having been duly made as provided by section 76 of the Public Health Law, as amended by chapter 468 of the Laws of 1903, permission is hereby given to the common council of Binghamton, N. Y., to discharge sewage from the Fourth ward outfall sewer into the waters of the Susquehanna river at Binghamton within the municipality of Binghamton in accordance with the plans accompanying the petition, under the following conditions:

1. That the time of expiration of this permit shall be April 1, 1910.

2. That the sanitary sewage of the portion of the Fourth ward, which is now or may become tributary to said Fourth ward outfall sewer, shall be collected in separate sanitary sewers into which no. storm water shall be allowed to enter: Said separate sanitary sewers to be permitted to temporarily discharge into the Fourth ward outfall sewer until treatment shall be required as under condition (3) of this permit.

3. That said separate sanitary sewers shall be so designed as to be readily intercepted by a separate sanitary outfall sewer leading to sewage treatment works, as provided under condition (5) of this permit, to be constructed in the future when such treatment works shall be required by the Commissioner of Health.

4. That the proposed 15-inch pipe sewer beneath the outfall channel be extended into the channel of the Susquehanna river with its outlet submerged at low-water stage.

5. That before the expiration of the time of this permit, plans for a complete system of intercepting sanitary sewers and sewage treatment works for the collection and treatment of the sewage of the entire city at a site favorably located below the city shall be submitted by the city of Binghamton to the State Commissioner of Health for his approval.

6. That the time of this permit may be extended at the discretion of the Commissioner of Health provided the conditions thereof have been fully complied with.

NOTE.— This permit to become operative must first be recorded in the county clerk's office of Broome county, in which the outlet of the sewer, or in which the establishment is located.

EUGENE H. PORTER,
State Commissioner of Health

March 29, 1907.

BOLIVAR

On February 7, 1907, original plans for sewerage and sewage disposal for the village of Bolivar were approved. Correspondence in the matter follows:

ALBANY, N. Y., *February* 6, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR: —An application for approval of plans for a sewerage system for the village of Bolivar, Allegany county, was received by this Department on December 8, 1906, from the village and after carefully examining the same, I beg to report as follows:

The plans were properly submitted in duplicate and were accompanied by duplicate copies of specifications and engineer's report. The plans submitted include:

1. One cloth mounted general map of sewer system. One tracing map of sewer system.

2. Two sheets of profiles of sewers on profile paper. One tracing cloth copy of profiles.

3. One sheet of details of sewer appurtenances on tracing cloth. Duplicate sheet of these details of sewer appurtenances on tracing cloth.

4. One sheet of detail drawings of treatment works on tracing cloth. Duplicate black print of treatment works from above tracing.

The proposed system shown on these plans is designed upon the separate system and includes a disposal plant for the purification of the sewage before discharging into the Little Genesee river.

The village of Bolivar is situated on the Little Genesee river about twelve miles above its junction with the Alleghany river.

Its present population is about 1,500. There are no municipalities of over 500 population on the Little Genesee river above or below Bolivar. The only large municipalities on the Little Genesee river below Bolivar are Olean and North Olean, with a population of about 12,000, situated some twenty miles below, and the village of Salamanca with a population of 6,000 situated some forty miles below.

The village is supplied with a public water system owned by a private company which, according to the report of the State Water Supply Commission, supplies about 350,000 gallons per day, to some 1,250 consumers. The source of the supply is not stated. The water is not filtered.

The estimated quantity of sewage which will be collected by the proposed system of sewers, upon its completion, will, according to the engineer's report, approximate 200,000 gallons per day. This is less than the water supply consumption according to the Water Supply Commission, but seems a reasonable amount for sewage contribution since, with an assumed rate of as high as 150 gallons per capita per day, the sewage from the total population would not amount to more than 210,000 gallons. This quantity of 200,000 is the amount for which the treatment works are designed and should accordingly amply provide for the needs of the village for some time after the completion of the system and before extension to the treatment works would be required.

Examination of the plans for the system of sewers indicate, that with the exception of a section of sewer on Main street north of Belmont street the sizes, grades and capacities are suitable for the present and future growths of the village; that ample provisions have been made for cleaning, flushing and ventilating them in a satisfactory manner; and, that, if constructed in accordance with the accompanying specifications, they should operate satisfactorily in practice.

In regard to the sewer on Main street, the accompanying letter of the consulting engineer to Messrs. Knight & Hopkins will explain the objections which he has taken to the size of this sewer, and the reply to this letter explains the reasons of the engineers in support of their design. They state, however, that "with the above explanations, if you still think the change should be made of enlarging the sewer, we can do it very readily."

After considering the reasons of the engineers, Knight & Hopkins, for retaining the size of the sewer referred to at 6″ instead of 8″, as suggested by me, I am still more of the opinion that the change to 8″ would be desirable. The reason for the smaller sewer suggested by Knight & Hopkins is equivalent to saying: that with a given grade, the smaller the quantity of flow the smaller should be the sewer in order to get a greater ratio of depth of flow to diameter of sewer and consequently a greater velocity. This can be done, however, only at a sacrifice of good velocities when flowing one-half full or entirely full. It is accordingly better, when minimum grades are at stake, to increase the diameter so that when flowing one-half full, or entirely full, the sewer will have a better cleaning velocity, and allow, at the same time, for greater facility in cleaning of these sewers when this is required. In case the flow is small to begin with, automatic or hand flushing can be resorted to during the early years the sewer is in use.

The plans for a sewage disposal plant comprise a septic tank with contact beds of 8 units. The tank has approximately eight hours' detention period, which is practically a minimum period for proper septic action. This tank, then, while having no appreciable factor of safety as to size, and not having partitions as will admit of shutting off one compartment for cleaning, is so designed and planned as to be easily extended in the future, and will, if carefully operated, satisfactorily provide for the sewage that will be tributary to it for some years to come.

The contact beds have a combined area of about four-tenths of an acre. The beds are approximately three feet deep, which is slightly shallow, according to best modern practice, for contact beds, and consequently will give a capacity somewhat less than beds of the usual four feet thickness. Beds of such a depth should, however, easily purify 500,000 gallons per acre daily, and accordingly the 0.4 acre of beds should, if properly operated, purify the 200,000 gallons for which they were designed.

In view of the foregoing, I recommend:

(*a*) That the plans and profiles of sewer system be returned for modification in the size of the Main street sewer north of Belmont street between the manhole first south of Merritt Hollow road and the manhole north of Merritt Hollow road first west of the P. S. & M. R. R.

(*b*) That as soon as the plans are again submitted with above modifications properly made, that the complete plans for sewerage and sewage disposal be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 8, 1907.

ALBERT J. MATSON, ESQ., *Village Clerk, Bolivar, N. Y.:*

DEAR SIR: — I am returning to you by express the approved plans for the sewerage system for the village of Bolivar.

I would recommend that the size of the Main street sewer north of Belmont street, between the manhole first south of Merritt Hollow road and the manhole north of Merritt Hollow road first west of the P. S. & M. R. R. be changed from 6″ to 8″.

I have notified the engineers that the plans have been returned to you and that they have been approved subject to this change.

Inclosed herewith you will find permit which should be filed in the county clerk's office as required by law.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

On February 7, 1907, a permit for the discharge of effluent from the sewage disposal plant for Bolivar was issued under the following conditions:

1. That the only sewage shall be that of the effluent from the disposal works for which plans are included in the above system.

2. That both the sewers and the disposal system used for such discharge shall be built in full conformity with the plans herein referred to, or such as may be subsequently approved by the State Department of Health.

3. That the length of time after the receipt of notice of revocation of this permit, within which the discharge of sewage from this system shall be discontinued, shall be one year, in accordance with section 78 of the Public Health Law.

4. That this permit shall be revocable at any time when, in

the judgment of the State Commissioner of Health, an appreciable pollution of the stream shall be caused or the operation of the disposal plant shall be unsatisfactory.

BRONXVILLE

Plans for house sewers and connections comprised in the sewer system of the Lawrence Park district, which was taken over by the village trustees, were approved on February 12, 1907. A plan for a sewer in DeWitt avenue was approved on July 23, 1907, and a permit was issued allowing the collection and delivery of sewage by said sewer into the sewage disposal plant at Bronxville.

CASTILE

On January 13, 1905, amended plans for a proposed sewer system were received at the Department, referred to the Consulting Engineer, examined and returned to the village authorities February 23, 1905, for correction.

The revised plans were filed with the Department on May 19, 1905, and had been approved tentatively except as to minor details and except as to the location of the sewage disposal plant.

On September 16, 1907, revised plans for sewerage and sewage disposal were submitted for approval.

These plans were approved on September 26, 1907, and a permit was issued to the board of sewer commissioners of Castile, allowing the discharge of effluent from the sewage disposal plant into Wolf creek.

ELMIRA

ALBANY, N. Y., *April* 23, 1907.

Dr. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— In the matter of plans for extensions to the sewer system of the city of Elmira, I beg to state that on March 15th, a map was submitted by the assistant and acting city engineer, Thurber A. Brown, showing plans for new sewers on First street, Church street and Hoffman street, in the district west of Hoffman's creek; on Fourth street, between Davis and Walnut; on Linden place, between Pratt and Oak streets, in the district east of the D., L. and W. R. R.; on Gregg street, in the second ward, and on Mt. Zoar, Jefferson, Home and Keefe streets, in the section of the city lying south of the Chemung river.

The city of Elmira is situated on the Chemung river in the central part of Chemung county. Its present population is about 35,000. This population is somewhat less than that shown by the census of 1900, though the city showed an increase in population of 5,000 from 1890 to 1900. Waverly, the next municipality of any considerable size on the Chemung below Elmira, has a population of 5,000, and is situated seventeen miles below at the Pennsylvania State line.

The water supply for Elmira is derived, mainly, 80 to 90 per cent. from the Chemung river and is in charge of the municipal water commissioners. The water is filtered through twenty-one Jewell mechanical filters and supplies over 90 per cent. of the population. The water consumption is from 4.5 to 6.5 million gallons daily.

The sewer system of the city is of the combined type and was constructed in 1883-5. There are two outlets discharging into the Chemung river. One outlet carrying all of the sewage and storm water from the portion of the city lying north of the river is located between Judson street and Newton creek, and is a brick sewer 53 by 69 inches in diameter. The other outlet sewer, which carries all the sewage and storm water from the portion of the city lying south of the river, discharges into the Chemung at the foot of Luce street and is a brick sewer 30 by 45 inches in diameter.

In view of the increasing pollution of the Chemung river by the cities along its course, it is evident that the treatment of the sewage of Elmira before its discharge into the Chemung river will at some future time become imperative. It is therefore advisable that as far as possible the future construction of sewers in the city should be carried on in such manner as to minimize the difficulty of separating sanitary or domestic sewage which will eventually require purification from the storm water sewage which will not require treatment before discharge.

In order to accomplish this in the most effective way and with the least expense to the city, I should recommend that certain boundaries be established around the present sewered districts of the city beyond which it shall be required by the Department that new sewers or sewer extensions be so planned that all sewers which receive sewage shall not receive any storm water, *i. e.,* there shall be a complete separation of storm water and sewage in different pipes or conduits.

On the north side of the river I would recommend that these boundaries be, roughly, Hoffman street, Roe avenue, Thurston street and Newton creek, on the west, north and east.

In regard to the proposed sewers on the north side of the river, for which plans are now presented for approval, the Fourth street, Linden place and Gregg street sewers are evidently intended to serve as combined sewers. Since these streets are within the sewered districts and the sewers planned are short extensions to the present system, of adequate grade and capacity, I would recommend that the plans for these three sewers be approved as presented.

In regard to the proposed sewers on First street, Church street and Hoffman street, on the north side of the river, I would recommend that the plans for these sewers be returned for further consideration by the city authorities with a view of determining whether their design shall be modified or they shall be finally presented in their present form as plans for separate or sanitary sewers into which no storm water shall be admitted.

The question of modifying the design of sewers in the outer districts of the city so as to change from the combined to the separate system is a matter requiring considerable study. At this time, however, and in view of the fact that the proposed sewers on the south side of the river in Home, Keefe, Mt. Zoar and Jefferson streets are extensions to a present combined system of sewers, I should recommend that the plans for the above proposed sewers on the south side of the river be approved as presented.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer.

ALBANY, N. Y., *April* 24, 1907.

Board of Public Works, Elmira, N. Y.:

GENTLEMEN: — I am herewith inclosing permit for the discharge of sewage from sewers in the following streets in the city of Elmira, in accordance with the application and plans recently submitted by Assistant and Acting City Engineer, Thurber A. Brown: Fourth street, between Davis and Walnut; Linden place, between Platt and Oak streets; Gregg street; Mt. Zoar street; Jefferson street, Home street, and Keefe street.

Under separate cover I am sending approved plans for above sewers, which approval, as in the case of the permit issued and for reasons hereinafter noted, does not include approval of the sewers in First street, Church street and Hoffman street.

Following out the general policy of this Department regarding stream pollution and under authority of the provisions of the Public Health Law relating to stream pollution, I have adopted the recommendations contained in the inclosed copy of the report of the Consulting Engineer and the future approval by this Department of plans for sewers in the city of Elmira will be considered in accordance with the outline presented in said report.

I am, therefore, withholding approval of the plans for sewers in the district west of Hoffman's creek until further communicated with by your board. A permit for the discharge of sewage from these proposed sewers will be issued when plans are received showing that no surface drainage or storm water is to be admitted, or when plans are received accompanied by a statement that the sewers are intended to serve only as sanitary sewers and not as combined sewers.

The approved plans for sewers as noted above are hereby returned. The map returned is a copy of the map submitted, the original being retained at this office.

In the matter of the report of public sewer systems required by section 79 of the Public Health Law, I beg to state that I have accepted and placed on file the report and accompanying map of the sewer system of the city of Elmira as it existed on May 7,

1903. which was recently submitted to this Department by Mr. Thurber A. Brown, Assistant and Acting City Engineer.

Very respectfully yours,

EUGENE H. PORTER,
Commissioner of Health

Plans for combined sewers in Fourth street, Linden place, Washington street, Mt. Zoar street, Jefferson street, Home street, and Keefe street were approved on April 24, 1907.

EASTVIEW

WESTCHESTER COUNTY ALMSHOUSE

ALBANY, N. Y., *February* 28, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— In the matter of revised plans for sewage disposal for the Westchester county almshouse, which are before the Department for approval, I beg to report as follows:

The original plans, which were approved June 20, 1906, show a septic tank of the following dimensions: length, 30 feet; width, 10 feet, and effective depth, 6 feet 8 inches. The revised plans show a modification of these dimensions as follows: Length, 30 feet; width, 12 feet, and depth, 5 feet 2 inches.

It thus appears that the only change in the plans for this disposal plant is in the cross-sectional measurements of the septic tank, and the figures of the revised plans indicate that its effective area is slightly greater than the effective area of the original plans. The depth in either case is sufficient and I am of the opinion that the septic tank, as shown upon the revised plans, will be as effective as that shown upon the original plans.

I therefore recommend that the revised plans be approved.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

On February 28th the revised plans were approved.

Subsequently a communication was received from the designing engineer stating that the original plans were followed in the construction of the plant.

FORT EDWARD

The following correspondence is self-explanatory:

FORT EDWARD, N. Y., *December* 17, 1906.

State Commissioner of Health, Albany, N. Y.:

DEAR SIR: — The village of Fort Edward, N. Y., through its board of trustees, hereby makes application to you for permission under the Public Health Law, section 76, to construct a system of sewers for the village according to plans approved by the State Commissioner of Health, February 25, 1903, and to postpone, until such time as you may determine, the construction of the disposal plant shown in the plans.

The estimated cost according to these plans is, for sewers, $55,000, septic tank, $7,400, contact beds, $11,000. It is the belief of the trustees that the public health of the village would be subserved by the construction of the sewers and that the location of Fort Edward is favorable, both as to the large minimum flow of the Hudson river and the absence of any municipalities for a considerable distance below, to the granting of this request, while the diminished cost to the village will tend to secure a favorable vote for the construction work.

Respectfully submitted,

DANIEL H. KEATING,
President

ATTEST:
JAMES M. MURRAY,
Village Clerk

ALBANY, N. Y., *January* 30, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— On December 17, 1906, an application was received from the authorities of the village of Fort Edward for permission to construct a sewerage system for said village in accordance with plans approved by the State Commissioner of Health, February 25, 1903, but with permission to postpone, until such time as the commissioner may determine, the construction of the disposal plant shown on said approved plan.

Since the date of this application, Mr. F. E. Crane, C. E., in charge of plans and proposed construction, called in person at the Department and furnished information in support of said application. On January 26, 1907, Mr. Crane and members of the village government called on the Department and submitted further information and made urgent request that a decision be given at the earliest practicable time.

The claims advanced in behalf of their petition are:

(a) On grounds of excessive cost and present high bonded indebtedness of the village.

(b) That other municipalities on the Hudson and tributaries above and below Fort Edward cause equal or greater pollution of the river than does Fort Edward, and consequently they feel that they are being in a measure discriminated against.

(c) That cities or villages below Fort Edward on the Hudson river generally do not use the unfiltered river water for the public water supply.

It appears from a review of the facts presented to me and records filed in the Department that plans for a complete sewerage system, including disposal plant, were approved in 1903, but that no construction has up to this time been started. The total estimated cost of the complete works are as follows:

Sewer system	$57,000
Septic tank	7,500
Contact beds	11,000

It appears further that notwithstanding the alleged financial burden of these proposed improvements the village has voted a bond issue of $80,000 to pay for these works.

As to the comparative pollution of the Hudson river below the village of Fort Edward, and other municipalities along its shores, it appears that the proposed construction of the State Barge Canal will cause not only a marked difference between the results of pollution by the sewage from Fort Edward and that caused by other municipalities along the Hudson river, but that this construction will produce a very different result than was anticipated at the time these plans were approved. The plans of the State Engineer in regard to the construction of the Barge Canal during the coming year or two will, when carried out, result in raising the low-water level of the Hudson river some few feet in height, and will create to a considerable extent a reservoir or basin which would have a considerable effect upon the proposed discharge of sewage from Fort Edward. In other words, the discharge of raw sewage at the upper end of such a basin will without purification result in the deposition of suspended matter in the sewage and tend in a marked degree toward the production of unsanitary conditions of the river below the village.

In regard to the question of municipalities located on the Hudson river and using the same as a source of water supply, it appears from the statistics of the State Department of Water Supply that the following municipalities below Fort Edward use the Hudson river for their source of water supply and to what extent the Hudson water is filtered.

Municipalities below Fort Edward using the Hudson river as a source of water supply.

Place	Source	Filtered or unfiltered
Waterford	River (Hudson)	Unfiltered
Troy	Lake and river (Hudson)	Unfiltered
Rensselaer	River (Hudson)	Filtered
Watervliet	River (Hudson)	Filtered
Albany	River and creeks	Filtered
Hudson	Stream and river	Filtered
Poughkeepsie	River	Filtered

From the foregoing it is evident:

(a) That since the people of Fort Edward have voted a bond issue of the full amount of construction with a margin of $5,000 in excess thereof, the claim of financial burden of constructing the complete disposal works is not well founded, and that even if it were advisable to cut out a portion of the complete sewerage works, it is more necessary to omit a portion of the sewerage system than any portion of the sewage disposal works.

(b) That the conditions surrounding this question with respect to Fort Edward are very different than those affecting other municipalities which at present pollute the Hudson river in so far as the Barge Canal will create at low water a basin or reservoir at the head of which will be discharged sewage or effluent from the sewerage works of Fort Edward.

(c) That there are some two or three municipalities below Fort Edward that take their supply from the Hudson river unfiltered, and that there are about four or five municipalities that take their supply from the same river after treatment by filtration.

In consideration of these facts I beg to recommend that the system of sewerage, including the complete works for sewage disposal, be required to be constructed by the village of Fort Edward in accordance with the original plans and approval thereof by the State Department of Health.

Very respectfully,

THEODORE HORTON,

Chief Engineer

AMSTERDAM, N. Y., *August* 9, 1907.

State Department of Health, Albany, N. Y.:

GENTLEMEN: — The village of Fort Edward, N. Y., requests me to submit revised plans of sewerage for that village to your Department for approval. Prints of the system, pumping plant, disposal works, including septic tank and sand filter beds, are inclosed.

These revised plans contain the following changes from the plans now on file:

The sewers are designed for house wastes only and consist of

40,683 feet of sewers from 8 to 12 inches in diameter. The entire sewage is brought to the Hudson river at Old Fort street and carried across the east branch of this river by gravity in a ten-inch iron pipe, to a pump well located on the island. From this pump well two four-inch centrifugal pumps, each direct connected to and driven by a motor, will force the sewage to a grit chamber 29½ feet above the bottom of the well. The sewage will then pass through a double septic tank into a dosing chamber. Automatic syphons will then send it to four sand filter beds, all located on the island. The soil of the island is suitable for forming the beds but, for the filtering material, sand will be drawn in.

With about eight miles of sewers it is estimated that the ground water can be kept within 240,000 gallons per day. The population of the village at present is estimated at 4,000. Within the next five or six years it is estimated that probably 160,000 gallons of sewage will be furnished by the village. The septic tanks have a capacity of 135,000 gallons or a detention period of eight hours for the above amount of sewage and ground water. Should the future flow of sewage require greater septic capacity another tank can be located on each side of those planned, and operated in connection with them. The sand filter beds, four in number, cover two acres of ground. Each acre will be required to treat 200,000 gallons of sewage and ground water per day, and as required in the future, other beds can be constructed on the island. The operating devises are automatic as far as practicable and at all stages the flow is controlled by valves and overflows.

Respectfully submitted,

F. E. CRANE, C. E.

ALBANY, N. Y., *September* 3, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I beg to report on my examination of the amended plans for sewers and sewage disposal for the village of Fort Edward, Washington county. The plans were received at this Department on August 24th from Mr. F. E. Crane, C. E., who, as engineer for the village, asked that the plans be approved.

A plan for sanitary sewers and a sewage disposal plant for the village, prepared by Mr. Crane, was approved by this Department on February 20, 1903. The system, however, was not constructed and the plans now before the Department propose several changes in the original design as approved and on file:

1. The diameter of many of the sewers is reduced on account of the fact that it is now proposed to exclude roof water from the system, whereas under the former plan, roof water in a considerable portion of the village was to be cared for by the sanitary sewers.
2. The location of the disposal plant is changed from a point near the foot of Old Fort street, near the east bank of the Hudson, to a point on an island in the river opposite Old Fort street. This forms an admirable situation for a sewage disposal plant, for although the upper end of the island is a residential district, the site of the disposal plant is about 1,000 feet distant on the lower end of the island which is not built up and is separated from the upper end by a high railroad embankment.
3. The character of the disposal plant is altered to this extent, that whereas under the first design, septic tank treatment was to be supplemented by contact bed treatment, the present design contemplates septic action followed by intermittent sand filtration. This change is made possible because of the greater area available on the island for the less expensive method of sand filtration.
4. It is not proposed, under the plans now before the Department, to construct as many lateral sewers as were shown on the original plan.

In regard to the sizes and capacities of sewers in the proposed system, it would appear that the capacity of the 12 inch trunk sewer on Broadway, from Washington street to Montgomery street, is sufficient to serve the future increased population which may reasonably be expected; also, it seems probable that the 12 inch trunk sewer through Notre Dame street, State street and Broadway to Montgomery street, would not be overtaxed within the life of the present system; the main trunk sewer, however, which is to carry the sewage of the entire village from the junction of the two above-mentioned sewers at the intersection of Montgomery street and Broadway to the manhole at the foot of Old Fort street, appears to be inadequate in capacity. The population of the village in 1900 was 3,521; in 1902, 3,830; in 1905, 3,806; and in 1907 is estimated at about 3,900 or 4,000. This shows an average increase in population of about 2 per cent. per annum.

However, from a study of the industrial conditions in the village it is not thought that such a rate of increase will continue but it is probable that a population of at least 5,000 will be reached within the period during which, from an economic standpoint, it would be well to provide sewerage facilities under the present design.

On the basis of 5,000 persons ultimately contributing to the entire system, allowing 100 gallons per person as the average rate and 200 gallons per person as the maximum rate of contribution and making due allowance for ground water infiltration, it will be found that the diameter of the main trunk sewer on Montgomery and Old Fort streets, if laid on the proposed grade of 0.12 per cent. and flowing two-thirds full, should be 15 inches instead of 12 inches as shown on plans.

In other respects the sizes, grades and capacities are adequate and the system well-designed. In several cases, 8-inch sewers are designed with grades of 0.32 per cent., but in all such cases flush tanks are provided at the ends of the sewers, and if properly operated will probably prevent stoppages in these rather flat sewers.

The location of the disposal plant as shown on the amended plan is much better than that shown on the original plan.

The capacity of the septic tank is sufficient to care for sewage from the population which it is expected will be connected with the system during the next six or eight years, after making a fair allowance for ground water. It might be suggested that especial provision for water-tight sewer joints be made in the specifications for sewer construction in all portions of the village where the ground water level is high. Certainly with such provision, if closely followed, and probably, also, under ordinarily careful construction, the infiltration of ground water may be kept down to a much smaller quantity than 240,000 gallons per day in the eight miles of proposed sewers. If this be so, then the capacity of the septic tank is evidently sufficient for the scope of the present design.

The septic tank and sand filter beds are so arranged that they may easily be enlarged if future sewage contribution demands greater operating capacity. The sand filter beds are designed with proper depth, area and arrangement to efficiently treat the septic sewage at the rate of 200,000 gallons per acre per day required, provided a satisfactory sand is used.

No data as to the sand to be used in the filters or schedule of operation of the filters accompanies the engineer's report regarding the dosing of the sand filters, giving effective size and uniformity coefficient of the sand, the void capacity in the sand, the size of the dose proposed, etc.

It is understood that the specifications for the original sewer system with slight modifications are to govern the construction of the amended sewer system, but the specifications for the sewage disposal plant, which did not accompany the plans, should be submitted before final approval.

In view of the foregoing, I would recommend that the plans be returned to the designing engineer accompanied by the statement that the plans will be approved by this Department when submitted in duplicate with the following corrections made and the following omissions supplied:

1. The main trunk sewer from the intersection of Broadway and Montgomery street, to the manhole at the foot of Old Fort street, should be increased in diameter from 12 inches to 15 inches.
2. Details as to the size, uniformity, quality, etc., of the sand to be used in the filter beds as well as a description of the proposed operation of the beds should be submitted.
3. Specifications of the disposal plant should accompany the plans.

Respectfully submitted,

H. B. CLEVELAND,

Assistant Sanitary Engineer

ALBANY, N. Y. *September* 4, 1907.

F. E. CRANE, C. E., *Amsterdam, N. Y.:*

DEAR SIR: — In the matter of the amended plans for sewerage and sewage disposal at Fort Edward which were recently submitted to this Department for approval, I beg to inform you that these plans have been examined by the Engineering Division of this Department and a copy of the engineer's report on said examination is inclosed herewith.

The plans are this day returned to you for correction, under separate cover. Upon a resubmission of the plans, with the corrections made and the omissions supplied which are noted in the accompanying report on their examination, the plans will be approved and a permit issued for the discharge of the effluent from the sewage disposal plant into the Hudson river.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

On September 17, 1907, the revised plans for sewerage and sewage disposal were approved and a permit was issued to the board of trustees of the village of Fort Edward allowing, under the usual conditions of revocation, the discharge of effluent from the sewage disposal plant into the Hudson river.

HARTSDALE

NEW YORK CITY, *October* 17, 1907.

HON. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — We have the honor to request in behalf of our client, Mr. George H. F. Schrader of Hartsdale, N. Y., the approval of your Department to discharge into the Bronx river sewage from a convalescent maternity hospital to be erected and endowed by him at Hartsdale, N. Y. It is proposed to construct a septic tank of suitable design on his property adjacent to the hospital and to discharge into the river the effluent only from this tank.

The reasons for making this request are that the property owned by our client is not of sufficient area to absorb all of the liquid wastes to be produced; that negotiations to purchase adjoining property for disposal purposes have failed and that the permanent drainage of the property will be to the Bronx valley sewer adjacent to the Bronx river, the completion of which sewer to this point may be expected within a couple of years. Permit to discharge into the river is therefore sought only for temporary purposes and our client will agree to a stipulation requiring him to cease discharge into the river immediately upon completion of the Bronx valley sewer.

The maximum number of people to be provided for is 100; the estimated water consumption is 7,500 gallons; the capacity of proposed septic tank is 7,000 gallons.

We attach hereto sketch showing location of property, the proposed septic tank and the location and size of the Bronx valley sewer for the construction of which proceedings have been initiated.

We shall be pleased to meet a representative of your Department on the ground by appointment should you deem it desirable.

Your prompt consideration of the matter is earnestly requested.

Yours respectfully,

LEDERLE & PROVOST,

BY S. J. PROVOST

ALBANY, N. Y., *October* 25, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — In the matter of plans and application for the discharge of sewage from the proposed Maternity Hospital into the Bronx river at Hartsdale, submitted by Lederle & Provost, Sanitary Experts and Hydraulic Engineers, in behalf of Mr. Geo. H. F. Schrader, I beg to say that I have carefully examined the plans and have to report as follows:

It is stated in the report of Lederle & Provost that the Maternity Hospital will accommodate about 100 persons and that the anticipated sewage flow will amount to about 7,500 gallons per day. These engineers propose the construction of a septic tank holding 24-hour capacity and to lead the effluent through a sewer about 1,000 feet in length to a temporary point of discharge into the Bronx river just south of the Hartsdale R. R. station. The ultimate disposal of this sewage is proposed to be into the Bronx valley intercepting sewer when this sewer is completed.

I have carefully inspected the plans and find that the system is carefully designed, the septic tank being of ample capacity for the purpose, and the sewers having proper grades, velocities, and capacities. The only question which seems to be involved, from the standpoint of approval of these plans, is that of allowing any additional sewage to be discharged into the Bronx river without complete purification.

As it appeared from the plans and as stated in the report of the engineers, there is little available area of a suitable nature and location with respect to buildings upon which appurtenances for complete purification can be installed. The quantity, at most, will be very small, only 7,500 gallons, or in round numbers only about 1 per cent. of that at present discharged from the White Plains precipitation works, and further, the location of the temporary outlet is at a point which would probably not be objectionable from the standpoint of appearance nor from offensive odors.

In view then of the small amount of land available for complete purification, the isolated location of the point of discharge, the small amount of liquid to be treated, it would seem to me reasonable to allow this partially purified sewage to be discharged into the Bronx river pending the construction of the proposed Bronx valley intercepting sewer.

I would, therefore, recommend that the plans be approved, and that a conditional permit be granted Mr. Schrader, of Hartsdale, to discharge the septicized sewage from this plant into the Bronx river, such permit to be revocable at any time when, in the opinion of the State Commissioner of Health, the sanitary condition of the Bronx river, resulting from the discharge of this effluent therein, makes it desirable.

Very respectfully,

THEODORE HORTON,

Chief Engineer

On October 28, 1907, a permit was issued in accordance with the recommendations of the chief engineer and on November 11, 1907, the plans were approved.

HONEOYE FALLS

ALBANY, N. Y., *December* 12, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — I beg to submit the following report on my examination of the plans for the proposed sewerage system and disposal plant for the village of Honeoye Falls, Monroe county, N. Y., received by this Department November 27, 1907, from Mr. Wm. J. White of Buffalo, N. Y.

The plans and documents received comprise the following:

1. Duplicate reports.
2. Duplicate specifications.

Tracings and white prints of the following sheets:

3. Topographical map and plan of sewers.
4. Three profile sheets of streets and sewers.
5. A sheet of details of manhole, lamphole, bridge crossing, ejector, etc.
6. A sheet of details of septic tank and accessories.

The village of Honeoye Falls is situated in the town of Mendon, Monroe county, N. Y., near the southern border of the county and about sixteen miles south of the city of Rochester. The corporation includes an area of about two square miles. Honeoye creek, a stream of considerable volume even in the dry season, runs through the village from south to north and has a drop within the village limits of 120 feet, controlled by dams at four different points. This stream is a tributary of the Genesee river and runs north and west through farm lands north of Rush and to Genesee Valley Junction where it enters the Genesee river. About one-half of the area of the village is comparatively level and most of the residence portion lies on this flatter portion, and future development will naturally be confined to this area.

The population of the village in 1900 was 1,200 inhabitants and little, if any, growth has occurred since. The withdrawal of the manufacturing industry which formerly obtained water power from Honeoye creek has left the village with little probability of development.

The village at the present time has no water supply, but is considering the question of installing one. The source of supply will be driven wells.

The sewerage system proposed is a separate system. It is proposed to allow roof water connection only by special permission of the village authorities and subject to revocation by them. The disposal plant consists of a septic tank located about 600 feet from the bank of Honeoye creek and discharging its effluent into Honeoye creek below its several dams and waterfalls.

The estimated daily flow is forty gallons per capita. This figure in advent of a water supply is low, but the capacity of the system will provide for more than twice this flow with allowance for a growth in population.

In my examination of the plans and profiles, I noted the following omissions and defects which, in my opinion, demand further consideration:

The design calls for about 15,000 feet of grades under 0.4 per cent. for an 8-inch tile. The minimum grade is as low as 0.15 per cent. and 0.2 and 0.3 per cent. predominate in this total of 15,000.

In the design of manholes, without change of size of tile, a drop is provided for of from 0.2 to 0.6 within the manhole. This drop seems excessive and might better be thrown into the grade, thus helping to increase the low grade mentioned.

On West Main street a 700 foot spacing of manholes occurs which might better be broken by a lamphole.

The provision for flushing is ample with the exception of the dead end of Ontario street, where the omission of a flush tank is probably an error in draughting.

On the profile of North Main street the creek does not appear and the method of crossing cannot be ascertained.

The septic tank is located well away from the town about 600 feet from the creek shore and high enough (13 feet) to survive the spring floods. Its capacity is 48,000 gallons, or a retention of twenty-four hours for forty gallons per capita for 1,200 people. Taking a flow of 100 gallons per day for 1,200 people, the tank gives a velocity of 0.07 per minute.

The tank will be adequate for any growth of the next ten or fifteen years, and its design, with careful operation, should produce satisfactory results.

In conclusion, I beg to recommend that the plans and profiles be returned to Mr. White, and that the following details be revised:

1. That in view of the topography of the village, grades below 0.35 per cent. for 8-inch sewers be increased to that minimum limit.

2. That the grades be, in general, run uniformly through the manholes, utilizing the drops planned within them to increase, to what extent they may, the low grades.

3. That the profile of North Main street be corrected to show the creek and the means of crossing it with the sewer.

4. That lampholes be inserted in the West Main street lateral sewer to relieve the long spacing of manholes.

5. That, in reference to the statement in Mr. White's report as to possible admission of roof water into this system of sewers, it be the policy of the trustees of the village to allow no roof water connections with the system.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 23, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR: — I beg to report on a second examination of the plans for a sewer system and sewage disposal plant for the village of Honeoye Falls.

These plans were returned for correction on December 12, 1907, having been submitted for approval on November 26, 1907. A schedule of criticisms was sent to the designing engineer, and the plans, as resubmitted, have been corrected so as to meet all the objections raised.

With respect to the type of sewage disposal plant, and the extent of purification proposed, I am of the opinion that treatment in a septic tank, as proposed in the plans, is sufficient for the present time, and for a reasonable number of years in the future in view of the fact that no public water supply is derived from Honeoye creek, or from Genesee river below the point of discharge of the creek.

In view of the foregoing, I would recommend that the plans be approved and a permit issued for the discharge of effluent from the sewage disposal plant into Honeoye creek. I have prepared such permit, with the usual conditions, for your approval.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

On December 23, 1907, the plans for sewerage and sewage disposal for the village of Honeoye Falls were approved and a conditional permit issued.

IRONDEQUOIT (Town), Monroe Co.

SUMMERVILLE SEWER COMMISSION

On August 30, 1906, plans for sewerage and sewage disposal for the Summerville sewer district, comprising Windsor Beach and Elm Beach in the town of Irondequoit, Monroe county, were submitted for approval.

ALBANY, N. Y., *September* 27, 1906.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — In regard to an application for approval of plans for a system of sewerage and sewage disposal for the portion of the town of Irondequoit, Monroe county, known as Windsor Beach and Elm Beach, received August 30, 1906, I beg to report as follows:

Without having the locality visited by one of our assistant engineers, I have made a careful examination of the plans submitted and beg to call attention to the following undesirable features which should be further considered by the town and the plans again submitted for approval.

The engineer in his report accompanying the application states that the per capita rate adopted in the design of the system is fifty gallons per day for average flow, increasing this to an equivalent of eighty-three gallons for maximum flow. He bases the figures on certain assumptions as to probable domestic use of water under the particular conditions which will exist at these places in the future. I consider these quantities too small to base computations for sizes for such a sewerage system. They should be about double this amount, notwithstanding the present actual water consumption and in order to allow for probable ground water leakage at certain seasons of the year.

Again I find on page 6 of the report a table giving velocities for vitrified sewer pipe of different sizes and grades. The pipes will not give these velocities with the grades stated under conditions usually met with in practice. In other words, the grades given in the table are below those which will give self-closing velocities in the sewers when these sewers have been in use some time.

Another question of considerable importance is that of draining of the portion of the district known as Windsor Beach to a separate and independent sewage disposal plant with a gravity outfall into the lake. The reason of the engineer for adopting two disposal plants is given on page 3 of his report as follows:

" This division was made, owing to the slope of the surface at Windsor Beach, in order to avoid deep trenches; also in order to avoid larger size of pipe and more expensive work through the boulevard at Elm Beach, where the sewer will of necessity be below the lake level, and lastly, as the works at Windsor Beach will operate by gravity, the pumping of a large portion of the sewage at the river plant will be avoided."

It is not at all clear that these reasons are sufficient to justify the introduction of a second disposal plant, with the additional maintenance required and with a location of discharge of effluent not so favorable as that into the Genesee river where the effluent from the Elm Beach plant discharges. In fact a study in the office indicates that by reversing the direction of slope of the Front street sewer, between Lincoln avenue and Monroe street, the sewage of Windsor Beach could be made to drain to the Elm Beach plant. The sewer cutting would be increased but slightly and the size of the sewers along the boulevard would have to be increased from eight inches to ten inches, a change that would be required notwithstanding the modification, as described later in this report. This, however, would be offset by eliminating the proposed sewers leading to and beyond the Windsor Beach disposal plant, and reduce the cost of construction and maintenance of sewage disposal by uniting the two plants into one plant.

In regard to the additional cost of pumping in case the Windsor Beach sewage is brought to the Elm Brook plant, it appears from a study of the matter that the cost will be relatively small. The pumping plant will not have to be increased since the plant is designed not to operate only a small percentage of the time. The only increase will be for power, and this for so small an amount of sewage to be pumped would be less than the interest on the money invested in outfall and sewage disposal works at Windsor Park. Even were this not so, the advantage of a more satisfactory point of discharge, a greater efficiency and economy of operating only one disposal plant and a less first cost of construction would offset any slight increased annual cost of pumping.

In view of the above, I should recommend that the plans be returned and that the following modifications and additional considerations be made in them, and that they again be submitted for approval.

1. The slope of all the 6-inch sewers be increased where necessary so that they will in no case be less than 0.67 per cent., or the sizes of these sewers be increased from six inches to eight inches, retaining grades now shown, thereby securing adequate self-closing velocities when these sewers will have been in use for some time. It will, at the same time, increase the capacities of these sewers where now they are insufficient for future requirement.

2. The direction and slope of the Front street sewer from Lincoln avenue to Monroe street be reversed, thereby allowing the sewage of the Windsor Beach district to be collected at a single pumping station and disposal plant with effluent discharging into the Genesee river; thereby doing away with the Windsor Beach disposal plant.

The size of the Elm Beach disposal plant and the main sewer leading to it will have to be increased, but this will give a more desirable point of sewage discharge and will conduce to more efficient, if not more economical, operation of the sewer system and sewage disposal plant.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 21, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR: — In regard to plans for a sewerage system for the villages of Windsor Beach and Summerville, in the town of Irondequoit, which are before the Department for approval, and which were returned to the village authorities for modification, I beg to report as follows:

These plans were returned together with a report of the Consulting Engineer regarding the modifications referred to. A revised plan has been submitted, upon which is shown the modifications recommended, accompanied by a request that if this revised plan is found satisfactory to the Commissioner of Health it be returned to the Engineer for transferring the modifications to the original plans. These plans will then be submitted for final approval.

I have carefully examined the revised plan submitted and find that the modifications have been made in accordance with the recommendations contained in my report to you dated September 22, 1906. If, therefore, the final plans are submitted embodying these modifications, as shown upon the revised plan, I should consider them to be satisfactory and ready to receive your approval.

Accompanying the revised plan was a formal application to the Department by the authorities of Windsor Beach and Summerville, to omit temporarily the disposal plant shown upon the original plans, providing that fine screening of the sewage at the outfall be substituted temporarily for the sewage disposal plant. The reasons advanced by the village authorities for this permission to temporarily omit the disposal plant is that the Genesee river is very badly polluted by the sewage of the city of Rochester, and that the discharge of screened sewage into the Genesee river at its mouth would not produce an appreciably greater pollution of the waters of Lake Ontario than now exist, and that no water supplies are taken from the lake at this point which could be affected by the discharge of this small increased amount of sewage.

I have carefully considered the effect which the discharge of screened sewage of Summerville and Windsor would have upon the waters of Genesee river and of Lake Ontario, and find:

1. That the amount of sewage which would be tributary to the proposed system of sewers upon its completion will be relatively small. Compared with the Rochester sewage, which is discharged into the river in a raw state, the amount, based on relative population, is not over 1 per cent.

2. That in the modification suggested by the Consulting Engineer in collecting the sewage of the entire district of Windsor Beach and Summerville at one point of discharge, at the mouth of the Genesee river, instead of two points as originally proposed, there is made possible a good opportunity for thorough dispersion of the sewage before it enters Lake Ontario.

3. By the introduction of fine screening practically all visual pollution will be eliminated from the sewage before its discharge into the stream, and if the outfall is carried out to the channel of the river no nuisance should result.

4. That no villages along the shore of Lake Ontario, of which we have a record, take their water supply close enough to the mouth of the Genesee river to be in any appreciable way affected by the discharge of the sewage of Windsor Beach and Summerville.

In view of the foregoing, then, I would recommend:

1. That as soon as the modifications shown upon the revised plan be transferred and embodied upon the original plans, that said plans be approved.

2. That permission be granted the villages of Windsor Beach and Summerville to discharge the sewage from the proposed system of sewers into the Genesee river at the point shown upon the plans for a period of one or two years on condition that fine screening of sewage be introduced with the system at the outfall and that this outfall be a submerged one and carried out into the channel.

Respectfully submitted,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *February* 28, 1907.

Mr. J. FRANK MORSE, *Attorney*, 328 *Powers Building, Rochester N. Y.:*

DEAR SIR: — In regard to plans for the sewerage system for the villages of Windsor Beach and Summerville, in the town of Irondequoit, which were returned to the village authorities for modification, I beg to advise you that our engineer made a careful examination of the plans submitted, and he recommends that as soon as the modifications shown upon these plans are transferred and embodied upon the original plans, the plans be approved. He also recommends that permission be granted to discharge sewage into the Genesee river for a period of one or two years on condition that fine screening of the sewage be introduced with the system at the outfall and that this outfall be a submerged one and carried out into the channel.

I have approved these recommendations, and duplicate plans with specifications, etc., should be submitted to the Department for its approval and will receive early attention when so submitted. The revised plan is herewith returned to you.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

On April 1, 1907, the plans were approved and a permit issued under the following conditions:

1. That the time of expiration of this permit shall be April 1, 1910.
2. That until a time when the sewage disposal works shall be required by the State Commissioner of Health, all the sewage from the proposed sewerage system be screened through fine screens in a manner to effectively remove all visual suspended matter before it is discharged into the river.
3. That the outfall sewer be extended into the channel of the river with its outlet submerged at low-water stage.

Owing to a technicality arising in relation to the sale of bonds, the plans were reapproved on October 11, 1907, and a permit issued embodying the same conditions shown above.

The Summerville Sewerage Commission later decided to install complete purification works as shown by the following communication.

February 18, 1908.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — Owing to the illness of Mr. J. Frank Morse your letter of the 14th inst. to Mr. Morse has been referred to me for reply. We have received verbal request from Lieutenant E. M. Walbridge of the Second Separate Naval Division, also a request from the Board of Supervisors of Monroe county, that we change the location of the outfall of the Summerville and Windsor Beach sewer to a point 400 or 500 feet farther north, and the matter is receiving our careful consideration.

The officers and members of the Second Separate Division of the Naval Militia do not fully understand the intent of the plans, as the outlet or discharge of the sewer will be carried to a point well out into the current of the Genesee river, and we do not believe that anything will be gained by a change of location, as objections will be raised by someone to any location.

In the matter of the sewage, the commissioners have decided to put in a complete filtration system at once and not avail themselves of your permit to drain the crude sewage directly to the river. This fact would seem to remove all objection to discharge into the river at point indicated on the plans. We have arranged with Lieutenant Walbridge for a conference during this week and have also notified the Board of Supervisors that the matter will be very carefully considered. We will notify them at once, should a change of location be deemed necessary.

Very truly yours,

J. E. SUMMERHAYS,
Secretary Summerville Sewer Commission

KENMORE

ALBANY, N. Y., *March* 25, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — In the matter of the application of the village of Kenmore, Erie county, for approval of plans for sewerage and storm drainage, I beg to report as follows:

The village of Kenmore was formerly a part of the town of Tonawanda. It was set apart and became an incorporated village September 5, 1899. Prior to incorporation, sewers were constructed in this portion of Tonawanda with outlet into the adjacent territory within the city of Buffalo. Street development in this section of Buffalo made it necessary for the town (now village of Kenmore) to dispose of its sewage and storm water by some other method than open surface discharge.

This necessity resulted in a mutual arrangement between Kenmore and Buffalo by which the Kenmore sewage should be discharged into the sewers of Buffalo. By act of Legislature, 1906, the city of Buffalo and village of Kenmore were enabled to enter into this agreement whereby the city was to receive the sewage of the village of Kenmore into its system through an extension of its system through Elmwood avenue to the village line.

Prior to, and, in a limited way, subsequent to this agreement extensions had been made to the Kenmore system. These sewer extensions were made without much regard to future requirements and were designed, or at least constructed as combined sewers, without manholes or other appurtenances requisite to a modern system of sewerage.

During January, 1907, plans of the existing system were submitted in person by Mr. Landsdowne, attorney, and Mr. Bush, Engineer, with application for their immediate approval. These plans were at once examined and were returned with the explanation that they were neither in the form of a report filed under the 1903 law, nor an application for extension (since they wished the existing sewers accepted), and with the recommendation that new plans be prepared showing exactly the sewers and the extensions for which application would be properly made. These recommendations also included many modifications, such as —

1. Separation of storm water from sewage.
2. Redivision of drainage area so that more advantageous collection of sewage could be secured.
3. Revising of grades of sewer extensions so that better velocities could be secured that would produce self-scouring and cleansing of the sewers.
4. That manholes be inserted for purpose of inspection and cleaning.

The revised plans, together with an application properly made out, with accompanying engineer's report and specifications, were finally submitted February 4, 1907. These plans show two complete systems, one a separate or sanitary system of sewers, and the other a storm drainage system. The point of discharge for the sanitary system is at present through two lines of sewers in Delaware avenue into the Hertel avenue sewer in Buffalo at Delaware avenue. The future outlet will be through Elmwood avenue sewer into the Hertel avenue sewer, it being the intention to divert the two sewers now in Delaware avenue down Lincoln avenue into this Elmwood avenue sewer. The sewers thus shown embody all the suggestions and modifications previously made. The sizes are adequate, grades sufficient, and in these and other respects the plans are satisfactory.

The storm water system has an outlet through Elmwood avenue into Hertel avenue sewer, this section of sewer on Elmwood avenue, between Kenmore avenue and Hertel avenue being a combined sewer. The system has, from the evidence given in the Engineer's report, been designed on narrow margin of capacity. It will suffice, however, to adequately carry off the storm water of this district for the present, although when the district becomes more thickly settled, and when more impervious street areas are constructed to carry off a greater percentage of rainfall, it will be necessary to relieve the system by larger or additional sewers.

Since the plans as now submitted embody all modifications previously recommended, and are otherwise satisfactory, I beg to recommend that they be approved.

Very respectfully,

THEODORE HORTON,

Chief Engineer

The plans were approved on April 3, 1907.

LANCASTER

On November 25, 1903, plans and specifications for a proposed sewer system for Lancaster were submitted to the Department for approval and on December 10, 1903, these plans were returned to the village authorities for certain corrections recommended in the report of the Consulting Engineer.

On March 1, 1904, revised plans were received at the Department and on April 15, 1904, a letter was addressed to the Board of Sewer Commissioners, stating the conditions under which plans for the sewage disposal plant would be approved. The plans were returned to the designing engineers on April 28, 1904.

Further correspondence follows:

BUFFALO, N. Y., *July* 26, 1907.

MR. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— The bearer, Mr. Jooss, has the plans, specifications, details and report for a sewer system, and sewage disposal plant for our village, and we have contracted with him to furnish the work necessary for the approval of said plans.

If any changes are necessary, to make the plans satisfactory to your Department, you would oblige us by kindly giving Mr. Jooss the information to that effect.

Kindly approve of the plans, as soon as possible, as our village is very much in need of a sewer system.

Very respectfully yours,

ALBERT C. SCHAFF,

Secretary

ALBANY, N. Y., *July* 30, 1907.

Mr. EUGENE H. PORTER, M. D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — I have the honor to report that I have carefully examined the plans, specifications, details and report for the sewer system as proposed by the village of Lancaster, N. Y., said plans being submitted personally by Mr. Jooss on July 29th. I find the same complete and satisfactory in every respect and recommend that plans be approved.

I desire, however, to add that the disposal plant as designed is of a capacity sufficient only for the present or for the natural growth of the village for a few years only and that it will be necessary to keep the same under observation in order that the disposal plant's capacity may not be overtaxed.

Very respectfully,

H. N. OGDEN,

Special Assistant Engineer

On July 30, 1907, the plans were approved and a permit for the discharge of effluent from the proposed sewage disposal plant into the waters of Cayuga creek was issued, subject to the usual conditions.

LESTERSHIRE

On October 30, 1907, a plan for a sewer extension on Arch street in the village of Lestershire was approved and a conditional permit issued subject to the same conditions and terminating on the same date as the permit issued to the village sewer commissioners on February 7, 1906.

LOCKPORT

On June 20 a plan was received for a sewer in Bristol avenue, with the city of Lockport, accompanied by an application from the Common Council for a permit to discharge sewage into the Park avenue drain. On June 24, 1907, the plan was approved and a permit issued.

MASSENA

On May 14th plans for an extension to the sewer system in the Pine Grove addition at Massena were submitted for approval. On June 26th the plans were approved and a conditional permit was issued.

MECHANICVILLE

MECHANICVILLE, N. Y., *June* 12, 1907.

MR. EUGENE H. PORTER, M. D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — The Board of Trustees of the village of Mechanicville, N. Y., hereby respectfully make application to the State Department of Health of the State of New York for permission to sewer into the Hudson river in the southern section of said village, at a point known as Arnold Street, according to plan submitted by Engineer Harmon E. Smith, which I am to-day mailing to you under separate cover.

Yours truly,

JOHN H. HUNT,

Clerk

The plans were revised at the request of the Department in order to provide for a collection of sewage which would be more advantageous when treatment of all sewage should be required.

ALBANY, N. Y., *August* 15, 1907.

Dr. E. H. PORTER, *Commissioner of Health, Albany, N. Y.*:

DEAR SIR: — I have the honor to report that I have carefully examined the plan and profiles submitted by Mr. H. M. Smith of the Arnold street sewer, and find the same as revised under date of August 10, 1907, shown on the plan in red, to be reasonable and satisfactory.

I recommend, therefore, that the same be approved in accordance with the conditions specified on the permit attached hereto.

Respectfully submitted,

H. N. OGDEN,
Special Assistant Engineer

A conditional permit for the discharge of sewage was issued on August 15, 1907, and the plans were approved on August 19, 1907.

MEDINA

MEDINA, N. Y., *February* 15, 1907.

Hon. EUGENE H. PORTER, *Albany, N. Y.*:

DEAR SIR: — On the 18th of September, 1906, I mailed you duplicate copies of the certificate of the Board of Health of the village of Medina, and also of the Board of Trustees, together with maps in regard to the addition to our sewer system. On October 5, 1906, I wrote you further, explaining said proposed amendment to the sewer system; and, on October 23d you replied, returning one of the maps, and approving the application under the provisions of the law and regulations governing the same, and pointing out some particulars to be incorporated in the amended maps and specifications when ready.

The sewer board of our village have employed Frederick K. Wing, a civil engineer of No. 910 White building, Buffalo, N. Y., who has prepared the proposed amended map, plans and profiles, of the sewer system for the eastern and southern portions of the village of Medina, and by his letter of the 14th inst. he informs me that he has sent duplicate copies of such plans and profiles to your department for approval, and you doubtless have received the same by this time.

Will you kindly take action on the same as promptly as possible? We are desirous that the same be put in satisfactory shape to your Department and approved in time so that we can advertise and let contract sufficiently early so that the outlet pipe from the foot of Church street to the main outlet sewer under the canal, near the foot of Main street, can be constructed in the bottom of the canal while the water is out for repairs during the ensuing spring. Hence the necessity for as prompt action as possible. Otherwise we shall be postponed one year in our work, and we are all ready and anxious to go ahead with the work next spring.

Any communication in regard to the matter, either directly to Mr. Wing, at his office at Buffalo, or to myself, will receive prompt attention.

Very respectfully,
JOHN J. RYAN,
Village Attorney

ALBANY, N. Y., *February* 21, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — In regard to the matter of sewer plans for the village of Medina, I beg to say that on September 18, 1906, a general plan of the village was received accompanied with an application for the construction of sewers in certain streets enumerated in the application, and for a permit to discharge the sewage from the proposed sewers into the main trunk outfall of the existing system.

The plan thus submitted did not have shown upon it any sewer, and in the report of the consulting engineer, dated October 12, 1906, the following recommendations were made in regard to it and the accompanying application:

(1) That the plans be returned and that, in accordance with Village Law, section 260, the proposed sewers be properly indicated upon them with the alignments, sizes and grades clearly marked in such a manner that any change from the original plans can be readily seen; and that in case of any such changes a statement of the extent and reasons therefor be submitted with the plan.

(2) That, in view of the ultimate necessity for sewage purification, storm water be excluded from said proposed sewers.

(3) That permission be granted to discharge the sewage of the village of Medina into Oak Orchard creek without purification until a time when the Commissioner of Health, in the interests of the health of residents or communities situated along Oak Orchard creek, below Medina, shall require the sewage of the village to be purified.

In accordance with the above recommendations the plans were returned to the village to have the required sewers put thereon, and on February 14, 1907, duplicate sets of plans were received showing a system of sewers, generally, in accordance with the recommendations of the consulting engineer, and accompanied by profiles and a supplementary detailed plan of the 24-inch branch outfall sewer connecting with the main outfall sewer. I have examined these plans and find that in general the sewers have been designed and indicated according to recommendations above set forth and are satisfactory with the exception of the 24-inch branch outfall sewer leading from the manhole about 100 feet west of Church street to a manhole on the existing outfall sewer in the bed of the Erie canal near West street, and of one or two sections of 8-inch sewer near the outer limits of the system, such as on Center street and North street.

In regard to the branch outfall sewer, it is proposed to construct some 1,520 feet of 24-inch pipe in the bed of the Erie canal leading from Church street to the Main street bridge, and joining the main outfall sewer at a manhole located in the bed of the canal. The line of 24-inch sewer, as thus shown, has two objections, namely, that a length of 1,500 feet of sewer without any intervening manholes is undesirable and not in accordance with modern practice, and that at the junction of this 24-inch pipe with the main outfall sewer there is a manhole located in the middle of the canal bed that must, of necessity, be submerged for a considerable portion of the year. These objectionable features might be avoided by breaking the alignment in this section of 1,520 feet of 24-inch pipe and placing an intermediate manhole on the southwest side of the Erie canal midway along this section and transferring the present junction manhole to the north side of the canal at West street. This arrangement would admit of having all manholes accessible at all seasons of the year, and would give a partial advantage of allowing the sewer to be constructed in the bed of the canal between these manholes with a shallow cut.

In regard to the sections of the 8-inch sewers referred to, it appears that on North street, Center street, Oak Orchard street, Chestnut street and Elm street, short sections of 8-inch sewers are shown with gradients of only 0.30 per cent. Such gradients are below the minimum grades generally accepted as admitting of self-cleaning velocities. For 8-inch sewers this minimum grade should not be less than 0.50 per cent. where this is possible, and not less than 0.4 under any circumstances.

In regard to the question of a permit for the discharge of sewage into Oak Orchard creek without purification, I beg to say that since the recommendations made in my report of October 12, in regard to this matter, I have learned, through the office of the State Barge Canal, of the possible removal of the dam on Tonawanda creek, which now diverts a portion of the water of this creek into Oak Orchard creek. If such a change is adopted it will have the result of decreasing the present effective drainage area of Oak Orchard creek at Medina from about 400 square miles to 150 square miles, with a corresponding reduction in the summer flow of about the same ratio.

In view of this possible change I consider it important in granting a permit to the village for the discharge of its sewage into Oak Orchard creek, that the time for which such a permit is issued be made a temporary one of short interval.

In view of the foregoing then, I beg to recommend:

First. That plans now filed with the Department be approved upon the following conditions:

(*a*) That the alignment of the branch outfall sewer leading from Church street to the bridge at Main street be broken so that an intermediate manhole be inserted, and that the location of the junction manhole be moved from the bed of the canal to a point on the north side of the canal.

(*b*) That the grades of all sections of 8-inch sewers now shown with a slope of less than 0.4 per cent. be modified so that the minimum grade shall not be less than 0.40 per cent.

Second. That owing to the uncertainties in regard to changes in the Erie canal and the diverting dam on Tonawanda creek, any permit for the discharge of sewage from the sewer system of Medina be limited to a short time, revocable at any time when, in the opinion of the Commissioner of Health, said possible changes or other conditions make the removal of sewage from Oak Orchard creek necessary.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

On February 27 the plans were approved and a permit issued allowing discharge of sewage into Oak Orchard creek under the usual conditions as to revocation.

On September 9, 1907, Mr. J. J. Ryan, attorney for the village of Medina, presented plans for a change of outlet of the Medina sewer system.

ALBANY, N. Y., *September* 20, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — I beg to report on my investigation of the proposed extension of the outlet sewer of the Medina sewer system.

On September 9, 1907, Mr. J. J. Ryan, attorney for the village, presented plans for such extension of the outlet sewer. These plans contemplated the extension on Glenwood avenue for a distance of about 3,000 feet to present sewer under what is known as Glenwood lake, which sewer was constructed about four years ago by The A. L. Swett Electric Light and Power Company, under orders from the village, and which sewer was later paid for by the village.

It was intended at that time to extend the present outlet to this sewer constructed by the Power Company and which leads under the dam to a point near the power house of said company. It is now further proposed to extend this sewer below the power house for a distance of 160 feet down stream. Question was raised as to the propriety of expending the amount of money necessary for this extension.

On September 18, I visited Medina and went over the proposed route for the sewer. The present discharge of the outlet sewer for the village system is into Glenwood lake at a point nearly opposite the corner of Gulf street and Glenwood avenue.

No evidence of sewage pollution was visible on the day of the inspection at the present point of discharge and if it were not for the questions: first, of sewage disposal at some future time and, second, of the allied question of the concentration of all sewage in the village at one point, the expediency of the extension might be questioned.

The Oak Orchard creek, as it existed when the present outlet sewer was constructed about twelve years ago, ran through a gorge 50 feet to 75 feet deep. Since then a dam has been constructed about three-fourths of a mile down stream from the present point of outlet which floods the valley to a depth of 30 to 40 feet and forms a lake with an area of about 150 acres. The banks are precipitous and no available land occurs near the present point of discharge which might be used for the disposal plant site. Disposal, therefore, would require the extension of the present outlet to some point where a disposal plant could be located. The section adjacent to Glenwood avenue is being rapidly built up and the proposed extension will serve as an outlet for future sewers in this locality. At the proposed point of discharge below the dam, a suitable location for a disposal plant occurs.

The overflow or spillway of the dam is located some distance from the power house and no surplus water above that used by the wheels passes through the tailrace except that relief gates which discharge into the tailrace may be operated. This woul tend to reduce the flow passing the proposed point of discharg but inasmuch as the power plant is designed to utilize the greate possible minimum flow, which minimum flow is the critical poin at which the pollution of the stream comes into prominence, i would seem that no objection to the proposed location of the outle can be reasonably made on such grounds.

At present one wheel is installed in the plant requiring in full operation 10,000 cubic feet per minute of flow, and within two weeks it is stated that a second wheel will be installed requiring an additional 10,000 cubic feet per minute of flow for full operation.

In view of the foregoing, I should recommend that the plans be approved as presented. The permit for the discharge of sewage, under the usual conditions of revocation, was granted February 27 of this year.

Respectfully submitted,
H. B. CLEVELAND,
Assistant Sanitary Engineer

On September 21, 1907, the plan for extension of the outlet sewer was approved.

MILFORD

Plans for minor changes in the sewer plans for the village of Milford were approved on January 2, 1907.

MT. KISCO

Under a special act of the Legislature, the village of Mt. Kisco and the city of New York were empowered to co-operate in the construction of a sewer system and sewage disposal plant for the village.

Accordingly amended plans were submitted for approval to supersede those approved December 31, 1906.

MOUNT KISCO, N. Y., *October* 13, 1907.

DR. EUGENE H. PORTER, *State Health Commissioner, Albany, N. Y.:*

DEAR SIR:— New York city has presented to the village of Mt. Kisco entirely new maps for sewers and disposal plant which both the city and village authorities deem far superior to those already approved by your board, but the cost to the village is over $50,000 greater and whether the taxpayers of the village will approve the new plans remains to be seen.

On the 26th inst. a special election occurs and it has been brought to our attention that the map should be approved by your board before that time or anything then determined would be illegal. Please wire me the earliest time I can see you and I will at once go to Albany with map.

Truly yours,

ISAAC W. TURNER,

President.

WHITE PLAINS, N. Y., *November* 27, 1907.

Hon. EUGENE H. PORTER, M.D., *Commissioner of the State Department of Health, Albany, N. Y.:*

DEAR SIR: — I have the honor to send you the following brief report on the proposed system of sewers for the village of Mount Kisco, which, so far as the village is concerned, is substantially the same plan as the one designed and reported upon by me five years ago, but modified by the construction and gradients necessary to carry the entire sewage of the village through trunk sewers, projected by the city of New York, but to be built by the village, and delivering it to a pumping station to be located near the junction of Branch brook and Kisco river, from which point a 10-inch force main is to be constructed by the city of New York for a length of about 3,600 feet up the river to the proposed site for disposal and filtration works. The city of New York is also to install the pumping station complete, and to build the disposal works (septic tank, contact beds and filtration plant) all to have a capacity of handling 400,000 gallons daily, or sufficient to provide for the present and future needs of the village, when fully settled.

There are two lines of trunk sewers to be built, the first an 18-inch sewer along Branch brook from its crossing by the northerly boundary line of the village to its entrance into Kisco river, a distance of about 8,200 feet, and a fall of 3 in 1,000, with an 8-inch branch having the same gradient, 1,250 feet in length from the head of the 18-inch sewer to Kisco avenue. The other line is a 12-inch sewer of two branches or sections, the first extending up the river from the most northerly crossing of Main street to the pumping station, about 2,400 feet with a fall of 3 in 1,000; and the other branch beginning at the most southerly crossing of Kisco river and Main street and extending down stream, with varying rate of fall, the minimum being 3 in 1,000, a distance of about 6,400 feet to the pumping station.

The delivery of the entire volume of the village sewage, calculated for three times the present population is thus obtained by gravity to be received at the point where it will be handled and treated by the city of New York and a pure effluent discharged into Kisco river.

The different districts, each with its own outfall, referred to in my previous report as A, B, C and D, will thus be merged into the present scheme and the drainage of all the different areas intercepted by the trunk sewers and carried to a single outfall, namely, the pumping station before mentioned.

It will be noticed that by this scheme the building of sewers across private property, except the short line from Marion street to Maple avenue, will be avoided.

The pumping and disposal works, to be built and maintained by the city of New York, are planned with a capacity to take care of and treat the maximum amount of sewage of the village after its entire area has been settled upon. The initial capacity will be 400,000 gallons a day with provision for extension if ever found necessary. The static head or lift will be 39 feet, or 44 feet including friction. The disposal plant consists of a receiving tank, pumping machinery, force main, septic tank, six contact beds, two gathering chambers and three filter beds; the latter are added as an additional precaution in order to secure in the highest degree, a pure effluent for discharge into Kisco river.

So far as the village is concerned, the entire works are a gravity system which will effectually drain the whole area within the village limits, even after it has been fully settled.

Very respectfully,
JOHN M. FARLEY

The amended plans were approved on October 24, 1907, and a conditional permit was issued on December 4, 1907.

NIAGARA FALLS

During 1907 plans for sewer extensions to the Buffalo avenue, Main street, Maple avenue, Garfield avenue and Pine avenue sewers were approved and provisional permits issued for the discharge of sewage into Niagara river.

NORTH OLEAN

In September, 1906, plans for sewers and sewage disposal for the village of North Olean were submitted for approval.

NORTH OLEAN, N. Y., *September* 22, 1906.

Mr. EUGENE H. PORTER:

DEAR SIR:—Although at our last village election held last March, the measure was carried by a good majority for the making of plans, specifications, etc., for sewering of this village, when it comes to the actual voting of the money for the cost of the sewer system, it will be met by a great deal of opposition, which in all probability will be at special election for same.

Now the people who are out and out in favor of sewers are of a unit in the matter of disposing of sewerage, viz.: they would like to be given the same privileges as the city of Olean, emptying direct to the Allegheny river and Olean creek.

We so closely join the city that the uninitiated do not know the difference but what we are a part or ward of the city, and it is very certain, that in the near future, the city will extend its lines and make it so.

Such being the case, and the State Department ever make a demand for disposal works or the like, both the village and city would be able to act in conjunction.

Hoping your Department will be able to grant the above as a wish of the majority, the board of trustees await your earliest reply.

Yours truly,
JOHN F. DONOVAN,
Village Clerk

ALBANY, N. Y., *October* 1, 1906.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— In regard to the application of the village of North Olean, Cattaraugus county, for approval of plans for systems of sewers and sewage disposal for portions of said village, with supplementary application to omit for the present time the sewage disposal plants contemplated in the proposed improvements, I beg to report as follows:

Without visiting the locality, I have carefully reviewed the plans and the engineer's report accompanying them and have considered the condition of pollution of the Allegheny river and Olean creek in respect to the propriety of the village of North Olean disposing of its sewage temporarily without purification.

Considering the first question of plans for sewers and sewage disposal, I find, after carefully inspecting them, that, in so far as the sewerage system is concerned, they meet the necessary requirements for the present and future growth of the village. The sizes of the main outfall and branch and lateral sewers are of sufficient capacity and suitable grades to operate satisfactorily in practice.

In regard to the sewage disposal plants, I find that there are one or two features that will interfere with their successful operation in practice.

The first of these is insufficiency of head upon these sprinkling filters to get a suitable spray during the operation. The heads shown upon the plans are between two and three feet at the River street plant and between four and five feet at the Buffalo street plant. It has been found in practice that the head required to suitably operate sprinkling filters is from seven to ten feet. If this head is not secured it has been found that the limiting circle to which the spray will be thrown will be so small as not to get the most effective percolating capacity of the bed.

Another undesirable feature in regard to both of these plants is that no apparatus or facilities are shown for properly dosing the sprinkling filters after leaving the septic tank. It is a very difficult matter to maintain a proper head upon the sprinklers without a dosing chamber supplied with an automatic discharge appliance unless hand regulation is resorted to, which is usually found to be more expensive than the automatic devices.

Another question which does not affect the operation of these plants, but does affect the life of them in practice, is the character of the material with which the septic tanks are constructed. They are shown constructed of wood, but this material in contact with sewage deteriorates very rapidly and it is very questionable economy to introduce it in the present case instead of masonry structures. Wooden construction, however, will lessen the first cost, which may be of considerable importance to the village.

In regard to the question of disposal of the sewage of North Olean into Olean creek and Two Mile creek without purification, it appears that, in regard to the Buffalo street outlet, the stream flow of Two Mile creek is inadequate during low summer flow to discharge into it the proposed quantity of sewage without creating a serious nuisance. Sewage purification should, therefore, not be omitted at this point.

In regard to the River street outlet, I find that the drainage area of Olean creek at this point is approximately 200 square miles, instead of 75 square miles, as stated in the engineer's report, and, although the summer flow is fairly well maintained, there is a dam below the proposed point of discharge which causes back water in the creek to a point above the proposed outfall. It is quite probable that under such conditions the discharge of raw sewage into this stream would cause deposits which, through septic action, would become objectionable. Considering the small dilution which would result during the dry summer months and the effect of pondage below the proposed point of discharge, I consider that purification should also be required at the River street outlet.

uld, therefore, recommend that the plans be returned to the town of Olean for modifications in the following respects:

1. That in the design of disposal plants the grades of the septic tanks and contact filters be so arranged as to give at least seven feet difference in level for operating the sprinkling filters.

2. That there be shown upon the plans the method or devices by which it is proposed to discharge the effluent from the septic tanks onto the sprinkling filters so that an effective head will be maintained upon the nozzles while the latter are discharging.

I should further recommend that both sewage disposal plants be required and constructed before any sewage is discharged into Olean creek and Two Mile creek.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 10, 1906.

T. B. LOUGHLEN, M. D., 168½ *Union street, Olean, N. Y.:*

DEAR SIR: — Replying to your communication of recent date, with reference to the plans for the sewers for the village of North Olean, the application of the local authorities for permission to discharge the raw sewage into the waters of this State renders it necessary for our Engineer to make a personal inspection of the local situation.

Owing to the large number of engagements he has, and the large amount of work in his hands, he has been unable to visit North Olean up to this time, but will go there as soon as possible.

As soon as I get his report in the matter it will be decided at once.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *November* 22, 1906.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — On October 1st I submitted a report upon plans for a proposed sewage system of North Olean, prepared by Knight & Hopkins and filed with application duly made by the village authorities of North Olean.

Recommendation was made in my report in regard to requirements for sewage disposal. These recommendations were based upon information of a more general nature, since pressure of other work at that time did not permit of a personal visit to the locality. Since the date of this report a supplementary application has been received from the village authorities for permission to postpone the construction of the two sewage disposal plants which formed a part of the original system shown upon the plans, and, in accordance with further direction from you, I have visited the village of North Olean and Olean city, conferred with various officials of each municipality, looked over conditions generally, and beg to report again as follows:

Considering only the question of temporarily omitting the sewage disposal plants, I found the conditions subsequently the same as outlined in my report of October 1st, viz.:

1. With regard to the proposed outlet at River street into Olean creek, the creek for about one mile below this point is a slack-water millpond, formed by a dam located near the junction of Olean creek and Allegany river. The creek at present is clear

and has apparently no pollution of any kind. At least no municipal sewerage systems discharge into it above North Olean, according to information obtained from the superintendent of the water department and village clerk of North Olean. There is little question that the volume of dilution of the small amount of sewage which it is proposed to discharge into the creek from North Olean would not normally create a nuisance, but, owing to slack water caused by the dam, there would probably result deposits in the stream bed which would create a nuisance during times of very low flow.

The argument raised in the application in reference to Olean city being allowed to discharge its sewers into Olean creek and Allegany river has not much force, since only one small sewer from the city discharges into Olean creek below the dam referred to where there is good dispersion and no slack water. The other and larger sewer discharges into the Allegany river where the dilution is much greater.

From inquiries at Olean I find that there is very little pollution of either Allegany river or Olean creek above Salamanca outside the city of Olean. It would then seem that if the purity of these streams and rivers in the State, especially those that flow into other States, like the Allegany river, is to be maintained in a pure state, it would be well to prevent now a further pollution of them.

The city of Olean and village of North Olean take their water supply from driven wells located within the city of Olean on the north bank of the Allegany river at a point below the smaller of the two existing sewer outlets from Olean City, and below the proposed outlet from North Olean, although probably more contamination would or even does come from ground pollution from residents in the city of Olean, it is possible that some contamination might come from the river itself, due to sewage discharged into it above the line of wells.

In regard to omitting the proposed sewage disposal plant on Two Mile creek at Buffalo street, this stream is so small and the requirement for sewerage as well as sewage disposal for a large tannery located on the stream in North Olean is so urgent that it is almost imperative that this disposal plant be not omitted.

In view of this additional information and personal inspection of the conditions at North Olean, I should recommend, as in my foregoing report, that to avoid the probability or at least the possibility of a nuisance along Olean creek below the proposed point of discharge which is in slack water above the existing dam; and to prevent the great likelihood of a nuisance along Two Mile creek in case raw sewage from the 200 population, which is estimated will discharge into it; that both purification plants be installed before any sewage is discharged into these two streams.

Very respectfully yours,

THEODORE NORTON,

Chief Engineer

ROME, N. Y., *January* 10, 1907.

THEODORE HORTON, Esq., *Consulting Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR: — We received on January 5th your report of October 1st last to the State Commissioner of Health regarding the North Olean sewerage system and treatment works. We thank you for making so early a report and regret it must have been overlooked and so not sent us earlier.

We note your criticisms in regard to the head on the sprinkling nozzles and the need of dosing tanks, but before revising the plans of the work we think it best to correspond with you regarding the matter, as we think some explanation from us may be necessary.

Our reasons for using the heads of from three to five feet on the nozzles were based largely upon the results of the experiments at Columbus, Ohio, and at the Massachusetts Institute of Technology Experiment Station, where, at the former, a head of four feet satisfactorily covered an area of 43.5 square feet, and, at the latter, forty-one inches head obtained and was reported as capable of being materially reduced if desired. The summary in the Columbus report on the sprinkling filters indicated that three to five feet only were required. We expected, and the specifications provide that the village is to furnish the nozzles, that such a design of nozzle would be adopted as would give a satisfactory sprinkling area without clogging, and that the design would need to be determined by trial.

Undoubtedly the greater the head the more satisfactory might be the operation of the sprinklers, but we were lead to the design by the desire to keep within all reasonable limits the cost of the two plants, which at the best are large for a village of that class.

The pump wells at the two works are small and would contain but a short period's sewage flow, with the effect that the automatic pumps would operate without being idle for any material length of time, and that consequently the overflow from the septic tanks, the latter having a relatively large area, would be fairly constant and the head on the spraying nozzles not very variable. This seemed to render not very important the use of dosing tanks, but they undoubtedly would be beneficial.

It appears to us that the number of nozzles should be increased over the number shown so as to have one for about each forty square feet of filter surface, and that if this were done dosing tanks certainly would be desirable and perhaps necessary if the heads were left as at present.

To elevate materially the septic tank at the larger works — the River street — would mean a large additional cost to the plant as it is of concrete and now only partially below the natural ground surface. The head on the nozzles here was about three feet, or three and one-half from flow line to filter surface. Probably without great additional cost the flow line of the tank could be elevated two feet. A dosing tank drawing eighteen inches or less of water operated by an automatic siphon could be easily formed at one end of the tank, which, with the number of nozzles increased, we believe would overcome in operation your objections at this site.

At the Buffalo street works where the difference in elevation between the filter bed surface and the flow line of the septic tank is five feet, we would judge that your objections as to head and dosing might be overcome by a similar dosing chamber at the end of the tank, and a similar increase in the number of nozzles, i. e., so that there would be at least one for each forty square feet of bed area. The cost of elevating the tank at these works would not be relatively as much as at the River street works, but our desire to keep down the cost of this plant is because such a small territory is at present sewered by it that the construction of this portion of the system might not be attempted if the cost of the treatment works appeared large to the village authorities.

We write you thus fully in regard to these works and assure you that it is entirely for reasons of economy that we make the above suggestions as to the kind of alterations at all at variance with your own. We recognize the spirit of your criticisms and thank you for them as well as for your favorable report upon the remainder of the system.

Trusting that we may hear from you as to what portion of our suggestions we may adopt in revising the plans, we remain,

Yours truly,

KNIGHT & HOPKINS

ALBANY, N. Y., *January* 25, 1907.

KNIGHT & HOPKINS, *Civil Engineers, Rome, N. Y.:*

DEAR SIRS:— In reply to your letter of January 10, 1907, would say with respect to recommendations contained in my report of October 1st that:

With regard to sprinkling head upon the filters, whereas lower heads than seven feet are being successfully used to spray sewage, in general there is little question that in most cases the extra piping and nozzles make the cost so great as to be usually unwarranted. Of course there are cases where very little head is available and, from what you say, this is probably the case with your Olean design.

In fact my recommendation was predicated for the most part upon the piping layout shown upon your plans, which with the space intervals shown between nozzles, is not sufficient to spray the unit areas contiguous to each nozzle. Unfortunately my time is too much occupied to study the design upon the ground, but accepting the information contained in your letter of January

10th as to ultimate available head, I would now approve of the adoption of a head not less than three feet, if the loss of head in the piping system will not reduce materially this head *at the nozzle,* and provided the number of nozzles be increased so that the effective spraying area will cover the entire beds.

In regard to the dosing chamber, I appreciate the *principle* of action you describe with respect to the septic tanks and the pumps. The difficulty which I anticipate is one due to the variation in head upon the sprinklers, which will result from the difference in rate of discharge into the tanks when the pumps are in action, and the rate of outflow into the sprinkling system. If, for instance, the sprinkling system should discharge faster than the pumps supply sewage to the tanks, the head would drop very slowly and there might be a long period when the nozzles would act under a very slight head. Again if the rate of inflow and outflow from the septic tank were approximately equal the whole system would have a tendency, when once started (limited only by rate of arrival of sewage at the station) to act continuously.

Not having the plans here I am discussing the matter mostly from memory and there may be facts about the operation which you intend to accomplish that are still not clearly understood by me. The piping system not being complete in design and arrangement left of course considerable for me to surmise.

In fact I consider the action of a small dosing chamber very superior to the method you have shown upon the plans already submitted, for with such a chamber dosing can be accomplished every two or three minutes. I should accordingly prefer to have these chambers included in your Olean layout in the manner suggested by you in your letter of January 10th.

Hoping this will explain satisfactorily our views in the matter, I am,

Very truly yours,

THEODORE HORTON,

Chief Engineer

ALBANY, N. Y., *February* 8, 1907.

MR. JOHN F. DONOVAN, *Village Clerk, North Olean, N. Y.:*

DEAR SIR:— I am returning to you by express the approved plans for the North Olean sewerage system and sewage disposal plant.

I also enclose you herewith permit for the same, which should be filed in the county clerk's office as required by law.

With reference to your application for permission to delay the construction of the sewage disposal plant and discharge the raw sewage directly into the stream; I have given this matter very careful consideration, have had an inspection of the local conditions made by the consulting engineer of the Department, and, after going over the matter carefully and giving all the facts in the case my earnest consideration, in my opinion this should not be done and I am therefore forced to deny the application of the village authorities for such permission.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

On February 7, 1907, the plans for a sewer system and sewage disposal plant for North Olean were approved and a conditional permit was issued. An amended permit was issued on May 24, 1907 which stated more definitely the points of discharge.

On January 8, 1907, amended plans showing slight changes in the sewer system were approved.

OWASCO COUNTRY CLUB — Cayuga Co.

On June 20th, amended plans for sewage disposal at the Owasco Country Club on Owasco lake were presented for approval. On June 24, 1907, the amended plans were approved and a conditional permit issued for the discharge of effluent from the plant into Owasco lake.

OGDENSBURG

During the year sewer extensions in King and Pine streets were approved and permits issued.

PALMYRA

ALBANY, N. Y., *April* 11, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR: — I beg to report on my examination of the plans for sewerage and sewage disposal for the village of Palmyra, Wayne county, which were recently submitted to you for approval by Mr. A. P. Seeley, village clerk.

On April 2d, plans for a sewer system and disposal plant were received at the Department and comprise the following maps and documents:

1. Tracing and blue print of general, contoured sewer map.
2. Tracing and blue print of two sheets of sewer profiles.
3. Tracing and blue print of sheet showing details or appurtenances.
4. Tracing and blue print showing design of sewage disposal plant.
5. Tracing and blue print of sheet of details for automatic feeds and timed siphons for operating contact beds.
6. A report (in duplicate) on the design of the sewer system and disposal plant.
7. A set of specifications (in duplicate) for the construction of the sewer system and sewage disposal plant.

The system designed is a separate system; i. e., no storm water or surface water is to be admitted to the sanitary sewers.

It is expected that about six miles of sewers will be at once constructed in the seven and one-tenth miles of streets within the village limits and south of the Erie canal.

The plans include treatment of the sewage through a septic tank and set of broken stone contact filters.

Palmyra is situated on the main line of the N. Y. C. & H. R. R., and on the south bank of Ganargua creek in the southwesterly section of Wayne county. The village was incorporated in 1828, and its present population is about 2,300, showing but a slight increase in the last fifteen years.

Ganargua creek rises in Ontario county, its principal tributary being Mud creek which rises west of Canandaigua lake. Ganargua creek flows easterly through Ontario and Wayne counties to the Clyde river, which is formed at Lyons by the junction of Ganargua creek and the Canandaigua outlet.

The Clyde river flows easterly and southeasterly to the Seneca river, which is the outlet of nearly all the central New York lakes and whose waters contribute to the Oswego river and finally reach Lake Ontario.

At Palmyra, the drainage area of the Ganargua creek is 206 square miles. There are no villages of any considerable size on the watershed above Palmyra.

Newark, eight and five-tenths miles east of Palmyra and about one mile south of Ganargua creek, is situated on Military run which has its outlet into Ganargua creek. The population of Newark is 4,500. During 1906, plans for a sewer system and sewage disposal plant for the village of Newark were approved by this Department.

Lyons, five miles east of Newark, has a population of 4,800. In 1897, plans for a sewer system and the disposal of sewage by broad irrigation were approved by the State Department (Board) of Health.

The village of Clyde, eleven miles east of Lyons, has a population of 2,600, and has extensive sewers discharging into the Clyde river.

Ten miles below the village of Clyde, the Clyde river empties into Seneca river.

As stated in designing engineers' report, the water works at Palmyra are owned by a private corporation, an excellent supply of water being obtained from springs near the central southern boundary of the village. The water is pumped to a 50-foot standpipe of some 120 feet above the general elevation of the business section of the village. The consumption is from 75,000 to 80,000 gallons per day. The houses are very generally connected, there being about 400 connections.

To determine the probable amount of sewage to be cared for by the sewer system and disposal plant, the basis used in the design was 5 persons to each 50-foot lot on all streets, each person contributing 100 gallons of sewage in 24 hours. The maximum rate of flow was taken at 150 per cent. of the average rate of flow, and this maximum rate, after adding 10 per cent. of the average rate of flow to allow for infiltration of ground water, amounting to 10,500 gallons per mile of sewer per day, gives the total maximum rate of flow which it is designed shall fill the sewer but one-half full.

I find that on the above basis the sewers are of proper capacity to eventually serve the population of 6,800 finally to be provided for in the life of the proposed system as stated in the report of the designing engineer.

The basis adopted for sewage contribution, as above described, is adequate and in accordance with general engineering practice in similar designing, while the allowance for increased population of the village seems to be reasonable. The premises of the design and the capacity of the system are, therefore, in my judgment, reasonably correct.

The size, gradient and consequent velocity of flow of all sewers with the exception of the sewer on Main street, west of Stafford avenue, appear to be properly designed. This Main street sewer should be carefully constructed and properly maintained and inspected if present plan is adhered to, but the gradient and design of this sewer might be improved, if either:

(1) the upper end were made shallower;
(2) the Main Street sewer, from Stafford street to Gates street, should be flattened with possibly an increase in size of from 8″ to 10″;
(3) the size of this section should be increased to 10″, and an especially large flush tank provided to maintain depth of flow and sufficient flushing.

The sewage disposal plant comprises:

(*a*) a septic tank arranged in two compartments so as to permit of flexibility of operation as to time of detention,

(*b*) four broken stone contact filters onto which the septic tank effluent is distributed alternately by means of automatic sewage feeds.

This method of treatment is effective and under the conditions existing at Palmyra, the design appears to be appropriate and economical.

The one criticism which I would make of the plant is in respect to the area and capacity of the broken stone filters.

On the second page of the Engineers' report, occurs the following: "It is not probable that a population of above 1,000 or 1,200 people will obtain sewer connection during the next six or eight years." From the fact that there are at present about 400 water connections, and that sewers are to be at once constructed in 6 miles of the total 7.1 miles of streets in the village, this estimate is undoubtedly too low, and should be increased to, say, 1,800. Then, on the basis, as before stated, of an allowance of 10,500 gallons per day per mile of sewer for ground water infiltration, and of 100 gallons per day, average contribution per person, the total quantity of sewage to be treated from 1,800 persons would be 244,000 gallons daily. Now if eight hours be assumed as the minimum of detention, when above ultimate sewage contribution shall be reached (the time of detention proposed not being stated in report) the combined capacity of the two compartments of the septic tank should be about 81,000 gallons to properly treat the entire sewage flow.

The computed capacity of each tank is 39,700 gallons, or 79,400 gallons together, so that the septic tank is of sufficient capacity to properly treat the entire sewage of the village during a period of usefulness for which economy demands that the plant shall be planned.

In respect to the area and capacity of the filters, it has been found, from wide experience, that contact filters do not operate satisfactorily and efficiently at much higher rates per acre per day than, say, 400,000 gallons for three-foot depths, 500,000 gallons for four-foot depths, 600,000 gallons for five-foot depths of filtering material. Therefore, with the delivery at the plant of 244,000 gallons of sewage daily, the area of the proposed filter beds, with a depth of three feet, should be about 0.6 of an acre. The total area of the four contact filters is, however, about 0.14 acres, and is, therefore, inadequate.

In order that the filters may not be operated in the early future at excessive rates, they should evidently be increased in area, and possibly increased in depth, unless ordinary high water conditions would too seriously interfere with their operation should their depth be increased.

In view of the foregoing, I should recommend that the plans be returned to the village authorities, accompanied by a statement setting forth:

(1) that final approval will be given when contact bed design is revised in accordance with above outline;
(2) that in other respects, the plans are well executed and satisfactory to this Department.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

On August 19, 1907, the corrected plans for a sewer system and sewage disposal plant for Palmyra were approved and a permit issued.

PERRY

ROME, N. Y., *April* 20, 1907.

E. H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — We are sending you under separate cover to-day, two tracing plans showing the proposed extension of the sewer system for the village of Perry, for which the village would like a permit and also the approval for the change of the size of the sewer on Euclid avenue from eight inches as originally approved by your Department to twelve inches as now proposed.

We have written to the board of trustees, asking them to make application for the permit and also for the approval of this change.

We would say in regard to the extension of the sewer system that in the year 1901, the village constructed, under plans prepared by us and approved by your Board, a large portion of the sewer system. The part constructed in 1901 was something over ten and one-quarter miles and included practically all of the built up section of the village, excluding the part now proposed to be constructed. This portion now proposed for immediate construction lies along Silver lake and its natural drainage at the present time is into Silver lake, above the point of intake of the water works system for the village. The village desires at the present time, to avoid all danger of contamination by the construction of the sewers now proposed. A petition has been filed, signed by the required number of petitioners, with the village clerk, asking for this construction, and the village authorities wish to submit this construction to a vote of the taxpayers, immediately, so that the sewers, if possible, may be constructed before the summer season or at least during this summer, so that possible pollution from the lake from this territory, which is largely that of a summer resort, may be prevented at as early a date as possible, and therefore the village authorities earnestly desire your early permit and approval of this extension and proposed change in size of sewer on Euclid avenue.

As to the proposed change in the sewer on Euclid avenue, we will state that adjoining the village of Perry on the south is a large religious assembly ground, which is peopled by several thousand summer residents and excursionists during the summer season, and that this increased size of pipe is made for the purpose of accommodating the assembly grounds with sewerage facilities in the future, thus further preventing the pollution of Silver lake. The corporation controlling the assembly grounds, we are informed, appreciate the necessity of caring for their sewage and are already considering the matter of sewering into the Perry system, this being their only available outlet.

We believe the application to you will come from the village of Perry within a few days and possibly as early as the receipt of these plans, and upon the granting of the permit and the approval of this slight change, will you kindly forward one copy of the plans of the board of trustees of Perry, N. Y., and oblige.

Yours truly,

KNIGHT & HOPKINS

ALBANY, N. Y., *May* 3, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — I beg to report on my examination of plans for the construction of sewers in Euclid avenue, Walker road, Lake road, and across private right of way to Federal street in the village of Perry, Wyoming county, which plans were recently submitted to this Department for approval by Mr. O. M. Bolton, village clerk.

These plans agree with the general plan for sewerage for the village of Perry, approved by the State Board of Health on September 20, 1900, except that the size of the Euclid avenue sewer has been increased from eight inches to twelve inches for one block north of Camp road.

According to a communication from the designing engineers, the object in view in increasing the size of this sewer is to provide sewerage facilities during the summer season for a considerable population at the Assembly grounds on Silver lake since no other means of disposing of sewage from these camps is feasible than through the sewer system of the village of Perry.

The construction of this sewer along the shores of Silver lake will tend to safeguard the water supply of the village of Perry since the intake to the water supply system is located down the lake from the upper portion of the district sewered and down the lake from the Silver Lake Assembly ground.

Although no precise data as to the summer population at the Assembly grounds was presented, it is believed that the capacity of the sewer proposed will be ample to serve this district as well as the section of the village through which it passes.

III. That this permit shall be revocable at any time by the State Commissioner of Health or subject to modification or change if, in the judgment of the State Commissioner of Health, it shall become necessary or desirable or if an appreciable pollution of the stream shall exist.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

On May 13 the plans were approved and a permit issued in accordance with the recommendation in the above report of the Chief Engineer.

ROCHESTER

Twelfth and Twenty-first Wards

ALBANY, N. Y., *June* 17, 1907.

Dr. E. H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— In accordance with the instructions of Mr. Horton contained in a letter dated June 12, I visited Rochester on June 14th to investigate the nuisance referred to in a letter of Dr. W. B. Cochrane to the Department under date of May 5, 1907. I find the conditions to be as follows:

Thomas creek is a small stream running through the Twenty-first ward of the city of Rochester and through a portion of the town of Brighton, discharging into the Irondequoit river about a half mile from the bay of the same name. The lower part of this creek is through a wild, picturesque glen, and the junction with the Irondequoit river is in a swamp of many hundred acres grown up with flag and sedge, through which both streams slowly meander. Between the city line and the glen just mentioned, the stream runs throught farm lands used as market gardens.

The stream is polluted in two ways. At the upper end of one of the three branches, the State discharges a drain said to be fifteen (15) inches diameter used to collect seepage from the Erie canal. This drain runs from the center of the former village of Brighton, now the Twenty-first ward of Rochester, parallel to the canal and about 500 feet therefrom, for a distance of about 1,000 feet. Into this State drain many sewers discharge, and the results on the stream are unmistakable and sufficient in themselves to account for the odors and deposits in the stream which are the reasons for the complaint.

There exists another cause of the pollution, namely — overflows from the East Side trunk sewer through the overflow outlet provided in University avenue. This trunk sewer was built in 1895 on account of the serious defilement of a number of small brooks, Thomas creek among the number, which gave rise to many suits for damages wherein the plaintiffs were successful. This trunk sewer begins near the Genesee river and extends easterly, northerly and westerly in such a way as to practically inclose the whole city and intercept the drainage which would naturally turn from the river to the small brooks, and returns all this drainage to the Genesee river about three miles down stream from the point of beginning, the total length of sewer being about eight miles. From the beginning to University avenue is a distance of 15,356 feet, and the sewer, starting at three feet diameter, has increased in that distance to a diameter of eight feet. In order to reduce the cost an overflow is provided at University avenue whereby a large quantity of storm water is taken out of the sewer and allowed to flow into Thomas creek. The designing engineer intended, and it is so stated in his report, that this overflow should come into use through the overflow weir provided, only a few times each year. It is claimed, however, that on account of the increased density of population in the territory adjoining, that this overflow is in frequent, if not continual, use, and that Thomas creek is thereby polluted to an equal, if not greater, extent than by the State sewer.

It is now proposed by the city of Rochester, and complete plans have been prepared for this purpose, to drain the Twenty-first ward (the former village of Brighton) to a single point and to pump the accumulated sewage into this trunk sewer just above this overflow. The residents of the town of Brighton, already complaining of the pollution of Thomas creek, suits for the pollution of which are already in progress against the city, are alarmed lest this additional amount of sewage should increase the conditions already unbearable. The essence of the complaint and the purpose of the investigation asked for is to prevent this discharge of the Twenty-first ward sewage into this trunk sewer.

I followed the course of Thomas creek from the canal to Irondequoit bay, and it is evident that that stream should not receive raw sewage. The city engineer, Mr. Fisher, assured me that while he had no personal knowledge of the capacity of the trunk sewer at that point, he believed it to be of sufficient size to take care of the relatively small addition without overtaxing its capacity. The supervisor of the town of Brighton, Mr. Babcock, and the health officer, Dr. Cochrane, assured me that they could produce witnesses to swear that the overflow frequently discharged sewage even without any storm water apparently inducing the same. I advised Mr. Fisher that it would be necessary to submit the plans for the Twenty-first ward sewer to the Department before work was commenced, and suggested to him the desirability of getting together data as to the present flow in the trunk sewer and the rainfall necessary to make the overflow act. This he promised to do, and the matter will have to be taken up further when this information is before the Department. The authorities in the Twenty-first ward have already taken up the proper procedure to discontinue the domestic sewage flow from the State sewer, so that the co-operation of the State Department is not asked for this purpose.

The whole question seems to be tied up with the problem of the future outfall of the city of Rochester, and might properly be taken up with that question except that the plans for the outfall will not be ready until September, while it is hoped to begin the construction of this Twenty-first ward system at once.

I recommend that no action be taken in the matter at present, which is satisfactory to the health officer and to Mr. Babcock, the supervisor, pending the presentation of the plans referred to; and that then the propriety of discharging the Twenty-first ward sewage into the trunk sewer be carefully considered with the alternative proposition of treating the sewage separately, and that the crude sewage overflow into the creek, called storm water, be also considered in the question of treatment.

Respectfully submitted,

H. N. OGDEN,
Special Assistant Engineer

ROCHESTER, N. Y., *July* 24, 1907.

Hon. EUGENE H. PORTER, *Commissioner State Board of Health, Albany, N. Y.:*

DEAR SIR: — I am transmitting herewith two copies of our report upon a "Separate Sewerage System for Portions of the 12th and 21st Wards, City of Rochester, N. Y." Accompanying each report is a general plan showing the sewers proposed in the territory, a general plan of the proposed pumping station and eleven maps and profiles of streets and sewers; also copies of the general specifications and the type plans used in the city of Rochester for the construction of sewers.

I trust that this material corresponds with the rules and regulations of your Department in this matter.

Very truly yours,

E. A. FISHER,
City Engineer

ALBANY, N. Y., *August* 16, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — I have to report that I have carefully examined the plans, specifications and profiles, submitted under date of July twenty-fourth, of a separate sewerage system for portions of the Twelfth and Twenty-first wards of the city of Rochester, N. Y.

I find that the sewers arranged for are adequate and satisfactory and that the system when built should fulfill all reasonable demands made upon it.

The method of disposal planned for is to receive the sewage from the territory considered, about 1,000 acres, into a storage tank, to be located at the intersection of Winton road, North and Atlantic avenues, said tank being designed to hold about 7½ hours flow. From this tank it is proposed to pump the sewage at intervals into the East Side Trunk sewer through a force main one mile long, the discharge being at the intersection of Culver road and Atlantic avenue.

This method of disposal I believe to be unwise for the following reasons:

The method is avowedly a temporary one (see engineer's report, page 4), and yet a large cost is to be incurred for the construction, which cost will doubtless later prevent the adoption of a more sanitary method of disposal.

The point of the East Side Trunk sewer at which it is proposed to discharge the sewage from the Twelfth and Twenty-first wards is where that sewer changes dimensions from about 8 feet to about 4 feet diameter, or where the capacity changes from about 400 cubic feet per second to about 40 cubic feet per second, the difference, or about 360 cubic feet per second, being taken out by an overflow weir and discharged into the north branch of Thomas creek. It has not been possible to get definite information from the city authorities as to the frequency of the use of this storm water discharge, though the city engineer, under date of August third, writes that " the only shower which has caused an overflow of the East Side Trunk sewer into Thomas creek since January 1, 1907, was the one which occurred July 8, 1907." On the other hand, your engineer was informed by the president of the town of Brighton, through which Thomas creek flows, that witnesses could be had to show that the overflow was in frequent use, *i. e.,* at nearly every hard rain.

The city engineer, under date of June twentieth, advised this Department that the lip of the overflow weir was four feet seven inches above the bottom of the sewer (sewer, seven feet ten inches in diameter) and that on June twenty-fifth — the hour not specified — the depth of flow in the sewer was one foot ten inches. The rainfall records show that there had been no rain greater than .4 inches since June sixth and no rain of as much as one inch since May twenty-sixth. The depth of flow on June twenty-fifth, therefore, represents probably only domestic sewage flow.

According to the report of Mr. Kuichling, the sewer below the overflow is four feet diameter on a grade of 1:1,000, the capacity of which is, therefore, about forty cubic feet per second.

But the depth of one foot ten inches, measured on June twenty-fifth, gives a discharge, as computed from the section of the sewer and the grade, of from thirty to thirty-five cubic feet per second, showing that the capacity of the four-foot sewer is already nearly reached and that the margin available for future increase on the line of the East Side Trunk sewer itself is no more if indeed as much as should reasonably be allowed. It would not then be wise to add even so small an amount as one cubic foot per second, which is the immediate amount estimated to be discharged from the Twelfth and Twenty-first wards.

But further, the East Side Trunk sewer is a combined sewer carrying in time of rain large quantities of storm water. The engineer in his design, as stated above, estimated a storm flow of 385 cubic feet per second from an area of about 1,330 acres, equivalent to a rate of rainfall of about one-quarter inch per hour, a very small allowance, even on the assumption that the density of population on a large part of the area is low. Certainly it is evident that, into the five to ten cubic feet of room available in the four-foot sewer, it will be impossible to put anything like three times the domestic flow, the amount designed, and also that any precipitation which is felt at all in the sewer must cause the overflow to come into action, discharging practically crude sewage into Thomas creek. Since the primary object of the construction of the sewer system in the Twelfth and Twenty-first wards is to remove sewage from this creek, discharging into the East Side Trunk sewer would, in my opinion, fail of its purpose, since it would only reach that sewer to overflow back, at frequent intervals, into the creek.

I recommend, therefore, that the plans be approved so far as the distribution system is concerned, but that the city authorities be notified that this Department cannot approve the method of disposal.

I am also of the opinion that the frequent discharge from the

East Side Trunk sewer, which must now take place, constitutes practically a discharge of raw sewage into the waters of Thomas creek and that the time must soon come when the city authorities will be obliged to dispose of this storm overflow in some other way than at present. It would be wise provision on their part, in designing a purification plant for the sewage from the Twelfth and Twenty-first wards, to consider the question of a rough treatment of this overflow also.

Respectfully submitted,

H. N. OGDEN,
Special Assistant Engineer

ALBANY, N. Y., *September* 3, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR: — In the matter of the application of the city of Rochester to discharge sewage from the Twelfth and Twenty-first wards, by pumping, into the East Side Trunk sewer, I have to make the following supplementary report.

On Friday, August 30, Messrs. Fisher and Skinner of the Engineering Department of the city of Rochester were in the office in conference with the writer on the question. They presented the attached statement, which may be summarized as follows:

1. The first cost of the proposed pumping plant is estimated at $20,000 as compared with $58,000 for purification plant. The annual charges of the pumping plant are estimated at $6,500 as compared with $2,400 for the purification plant.
2. The present population is 1,200 on whom the assessment for the entire cost of the works must now fall and to whom the difference of $38,000 will be important.
3. While if use is made of the East Side Trunk sewer, the locality must pay a portion of the cost of the East Side Trunk sewer, estimated at $2,000 per year for the next

thirty years, yet on the other hand, if purification works are delayed till the whole city is considered, the city as a whole would construct the works for the Twelfth and Twenty-first wards' sewer system.

4. It has been found that the effect of the 4-foot sewer is to back up the sewage in the 8-foot sewer so that the hydraulic gradient is much less than the profile of the sewer shows. A weir was built in the sewer and the actual dry weather discharge found to be about six cubic feet per second, with a possible increase to nine cubic feet per second when the territory is fully developed. The capacity of the 4-foot sewer at the time of overflow being forty-eight cubic feet per second, the dilution is thus established at about eight times at present with a future minimum of five times.
5. The proposition to pump into the large sewer and the continuance of the present overflow carries with it as an integral part the proposition to improve and line with concrete the present channel of Thomas creek, the grade being such that with the improved channel no deposits are likely to take place.

These facts, which I believe to be established, are such that from an engineering standpoint I can see no objection to the proposed plans.

Respectfully submitted,
H. N. OGDEN,
Acting Chief Engineer

ALBANY, N. Y., *October* 21, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR: — With respect to the application for approval of the plans for a system of sanitary sewers for the Twelfth and Twenty-first wards of the city of Rochester, submitted July 24, 1906, I beg to say that I have reviewed the matter in the premises, and have carefully considered the reports of H. N. Ogden, Assistant Sanitary Engineer, and the subsequent letters from the authorities of the city of Rochester and the town of Brighton with reference to it.

It appears that the town of Brighton first objected to the plans which included a pumping plant protected by an overflow into Thomas creek, on the grounds that the overflow, during certain seasons and conditions, would pollute Thomas creek in a manner to create a nuisance. The evidence, as presented in the report of H. N. Ogden, dated August 16th, seemed to bear out this claim and objection on the part of the town of Brighton, and in consequence, Mr. Ogden, in that report, recommended that these plans be not approved.

Later data furnished by the city engineer seemed to indicate that owing to assessment of cost and other considerations, the withholding of approval would result in a delay if not a greater postponement of the improvement, whereas the immediate construction would be a relief and benefit to the town of Brighton. After a further consideration of this latter information, Prof. Ogden, in his subsequent report of September 3, 1907, recommends that the plans, as submitted, be approved.

In consideration, then, of the recommendations in the last report of Prof. Ogden, and of the recent letter from the town of Brighton, dated October 1, 1907, in which the town officials withdraw all objections to the proposed plans and favor the proposition as one best suited to all parties concerned, I beg to recommend that the plans proposed and specifications as originally submitted be at once approved.

Very respectfully,

THEODORE HORTON,
Chief Engineer

The plans were approved on October 24, 1907, and a permit for the discharge into the Genesee river through the force main and East Side interceptor was issued. The permit expires on January 1, 1910, and is revocable at any time by the State Commissioner of Health when in his opinion, the overflow of sewage from the East Side Trunk sewer into Thomas creek shall become objectionable or for any other reason.

RYE

Original plans for a general sewer system for the village of Rye were approved on June 1, 1907, subject to the subsequent approval by this Department of the detailed working drawings, plans and profiles of sewers, disposal works and specifications of construction, before construction is begun, and subject to such changes and alterations at this Department may direct when such plans are approved.

SCHENECTADY

ALBANY, N. Y., *November* 1, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— In the matter of plans for a marginal outfall intercepting sewer on the south side of Mohawk river in the city of Schenectady which are before the Department for approval, I beg to report:

On October 31st, I visited Schenectady and reviewed with the city engineer, Mr. L. B. Sobring, the question of design and route of the proposed intercepting sewer; the proposed method and route of extending this sewer from the lower end at Mohawk avenue to the disposal plant; the possible and proposed methods of collecting the sewage of other portions of the city at this point in Mohawk avenue or at the disposal works; and other features connected with the future collection and disposal of the city sewage. In company with Mr. Sebring, I also drove over and inspected the proposed route of this sewer, and obtained a general view of the proposed location of the disposal works and of the sewerage districts ultimately to be served by similar intercepting outfall sewers.

It appears that the proposed intercepting sewer shown upon the present plans will constitute a relief sewer for portions of the Fifth, Eighth, Ninth and Tenth wards, plans of a sewerage system for which were approved May 22, 1906; and for the relief of sewers in other and older sections of the city. It is proposed to collect the sewage from other sections of the city also at the lower end of this sewer at Mohawk avenue and to establish a pumping station here to deliver the entire sewage of the city to a proposed purification plant at a suitable site across the river as provided for in the plans approved and in the permit granted on May 22, 1906.

The city of Schenectady has had an unusual growth in the past decade and the system originally designed has necessitated some modifications in order to meet this increased and unexpected distribution of population. Some of these modifications have been carefully considered and embodied in the design of the proposed interceptor, and after careful examination, I feel that the sizes, grades and capacities are such as to meet all requirements for sewerage of the districts to be served thereby that can reasonably be expected in the future.

It should be noted that no point of discharge into the river is shown on the plans for the intercepting sewer but, instead, there is indicated upon the profile, a pumping station at the river just west of Mohawk avenue. There is, further, no request in the application, dated September 18, 1907, for any approval for temporary or permanent discharge of sewage from this interceptor into the river. It is reasonable to infer, then, that the principal, or only, object of receiving your approval of these plans at this time is to enable the city to proceed with the condemnation of property along the sewer route. It would seem to me that, under these circumstances, no " permit " is necessary.

In view of the foregoing, then, I beg to recommend that the plans as presented showing this marginal intercepting sewer on the south side of Mohawk river from Cowhorn creek to Mohawk avenue, be approved.

Very respectfully,

THEODORE HORTON,

Chief Engineer

On November 11, 1907, the plans for the outfall sewer were approved.

STATE INSTITUTIONS

Plans for sewerage and sewage disposal for State institutions, prepared by the Engineering Division of this Department during 1906 and 1907, have been approved as follows:

Kings Park State Hospital, Long Island, January 2, 1907.
Newark Custodial Asylum, April 3, 1907.
Rome Custodial Asylum, September 20, 1906.
Rush Industrial Institution, January 15, 1907.

These plans are described elsewhere in this report.

TUCKAHOE

ALBANY, N. Y., *October* 8, 1907.

EUGENE H. PORTER, M. D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I beg to report on my examination of the plans for sewer extension in the village of Tuckahoe, Westchester county, recently submitted for approval.

The plan submitted indicates proposed sewer extensions on Harrison, High, Garfield and Wallace streets, and Terrace place.

These sewers and some of the streets named were not shown on the general sewer plan for the village approved on June 20, 1906. The streets named are, however, within the area covered by the general plan and do not represent additional districts.

Profiles of the sewers named are submitted.

I find that the sewers are so designed as to afford proper capacity and velocity of flow and in other respects are well planned. and would, therefore, recommend their approval.

I have prepared a permit for your approval and signature allowing discharge of sewage from these sewers into the Bronx river after treatment at the sewage disposal plant connected with the system. This permit does not include the sewers on Summit street, Marble place and Union place, although sewers in these streets were shown as proposed sewers on the map submitted. The village engineer, in a statement over the telephone, said that the above three sewers were not built and that approval of the plan for these sewers was not asked, corroborating the application in the matter in so far as these three sewers were not named in said application.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

On October 11 the plans were approved and a permit issued, under the usual conditions as to revocation, for the discharge of sewage into the Bronx river after treatment at the Tuckahoe disposal plant.

WATERTOWN

Plans for sewer extension on Arlington and Academy streets were submitted August 26, 1907.

A communication was received from City Engineer Baker, accompanied by certified copies of resolutions of the board of public works of the city submitting above plans for approval.

On September 9, 1907, the plans were approved and permit issued.

WAVERLY

WAVERLY, N. Y., *April 27*, 1906.

EUGENE H. PORTER, M. D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — In accordance with conference had with Mr. A. H. Seymour, secretary, at his office on the 25th inst., I would respectfully ask that you examine the sewer plans left in the hands of Mr. Seymour, and ask that you advise me whether we would be permitted to empty our sewerage in the Cayuta creek, as indicated by the engineers' survey without a disposal plant. If we are obliged to use a disposal plant, I would like to know whether the septic tanks would be sufficient to take care of our system without using the contact beds, until such time as our system is entirely completed.

In connection with a disposal plant, we would like to ask your advice as to whether you would approve of a disposal plant that is not above or protected from high water. We would also like to know whether we would be permitted to empty into the Chemung river at the State line without a disposal plant. We do not know of any water supply taken from that river at any point below this outlet.

We would also like to ask whether in your judgment the disposal plant located at the point indicated on the plans for our village would be effective taking into consideration the level of the sewer at the corner of Broad street and Cayuta avenue and the level at the point indicated for the location of the disposal plant.

Hoping to receive your usual prompt attention, I remain,

Very truly yours,

O. H. LAWRENCE,

President

ALBANY, N. Y., *March* 12, 1907

EUGENE H. PORTER, M. D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR: — In the matter of plans for a sewer system and sewage disposal plant for the village of Waverly, Tioga county, which plans were submitted to me for examination, I beg to report as follows:

On January 13, 1906, the original plans, which did not include disposal plant plans, were submitted to the Department. Subsequently, as a result of a conference at the office of the Department, the plans were withdrawn in order that certain changes desired by the village and by the Department might be made.

On April 25, 1906, the plans were again submitted and after an examination of the plans had been made, they were returned to the village for correction accompanied by the Engineer's report which noted the omission of the design of the septic tank and contact beds comprising the sewage disposal plant (described in the Engineer's report submitted with the plans) as well as other omissions respecting duplicate copies of maps and documents, detail plans of sewer appurtenances and data in regard to certain sewers. This report of the examination of the plans closed as follows: " In other respects the plans are very complete and evidence careful designing, and prompt action may be taken by the Department when a proper set has been submitted."

On November 19, 1906, the plans under consideration were submitted to the Department and comprise:

1. Two blue print copies and one black print copy of general sewer map.

2. One set blue print copies and one set black print copies of nine sheets of profiles.

3. Two bound copies of the Engineers' report, together with Form of Advertisement, Instructions to Bidders, Proposal, Contract, Specifications and Bond for the construction of the sewer system and sewage disposal plant.

4. One blue print copy and one black print copy of " Details of Sewerage " (manholes, etc.).

5. One blue print copy and one black print copy of drawing of septic tank.

6. One blue print copy and one black print copy of drawing showing assembled septic tank, contact beds and sludge bed comprising sewage disposal plant.

On November 24, 1906, there was received:

7. Revised estimate of cost of sewers, not in duplicate (with the following note):

> To accompany Engineers' report submitted to the village of Waverly, N. Y., and to be substituted for the estimate of cost contained therein.

The plans propose a separate system of sewers and the treatment of all domestic sewage in septic tanks and contact beds before final discharge into Cayuta creek.

The village of Waverly is situated between the Chemung river on the west and Cayuta creek on the east, in the southwest corner of Tioga county, and the south boundary of the village is the northerly line of the State of Pennsylvania. Its present population is about 5,000. Cayuta creek, which has a drainage area of about 145 square miles, empties into the Susquehanna river two miles below Waverly. The villages of Sayre, Pa., and Athens, Pa., located on the Susquehanna two and three and one-half miles respectively, below the mouth of the Cayuta, have populations of 5,300 and 3,800 respectively. The water supplies of these two villages is taken from the Susquehanna, and filtered by mechanical filters.

The village is supplied with a public water system owned by a private water company. The water supply is derived from springs and brooks and is not filtered.

The estimated quantity of sewage which will be collected by the proposed system of sewers upon its completion, according to the Engineers' report and a recently submitted supplemental report, will approximate 330,000 gallons per day. This is equivalent to 110 gallons per person from 3,000 persons.

The estimated future population of the village with respect to which the capacity of the sewers was determined is 10,000. This appears to be a rational assumption both as to immediate sewage contribution and future contribution from an increased population.

An inspection of the plans for the system of sewers shows that the system is well designed and that the sizes, grades and capacities are suitable and well balanced for the present and future growth of the village. In the event of an unlooked for increase in population, the short, main outlet sewer leading from Cayuta and Broad streets to the disposal plant might be relaid with larger pipe and thus at comparatively small expense increase the capacity of the system as a whole.

A discrepancy is noted in the sizes of the Broad and Orchard street sewers as marked on map and profile as compared to the sizes recommended in the engineer's report. Care should be taken that the sizes for these sewers noted in engineer's report should not be confused with the sizes as finally designed and marked on map and profile.

The plans for the sewage disposal plant comprise a septic tank with contact bed of five units. The time of detention will be about eight hours. As the quantity of sewage contributed increases with the extension of the sewer system and increase in population of the village, more compartments of the septic tank may be constructed in addition to the one contemplated on initial installation and more contact bed units may be added without sacrifice of first construction. The contact beds have a combined area of 1.04 acres and a depth of 4 feet of filtering material. This will afford a rate of treatment of about 317,000 gallons per acre per day and the operation of the beds should be satisfactory even after the amount of sewage received at the plant is considerably increased.

In regard to the matter of location of the disposal plant and the grades of the contact beds and effluent discharge pipe, it appears that Mr. H. N. Ogden, assistant engineer, has visited Waverly for the purpose of considering this matter, that he has conferred with and corresponded with the engineers with respect to them and that the plans for disposal now before the Department embody the suggestions and understandings reached at the time these matters were under consideration. In fact, it is brought out by Professor Ogden that the location of the plant, grades, etc., as shown upon the plans, are not exactly what would be desired, although they might possibly be condoned under the topographical conditions of the village. Since, however, these matters have been carefully looked into by Assistant Engineer Ogden, and his advice has already been given and acted upon by them, I will not at this time consider them further nor suggest any changes in them.

Although the question was once raised as to whether the Department would permit the omission of all or any part of the sewage disposal plant, as the matter now stands this plant is to be constructed simultaneously with the sewer system and the system is not to be used until the disposal plant is completed. This is very important for there are two villages in Pennsylvania, Sayre and Athens, located below Waverly on the Susquehanna river within a few miles of it which use the Susquehanna river for sources of water supplies. Although both villages filter their supplies, the distances from the Waverly discharge sewer to the water supply intakes of these villages are so short that the additional safeguard of sewage disposal is, in my judgment, necessary for full protection.

In view of the foregoing, then, I beg to recommend that the sewerage plans for Waverly, as submitted, be approved and a permit issued for the discharge of the effluent from the sewage disposal plant into Cayuta creek for a period of five years, conditional upon proper and efficient operation.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

On March 15, 1907, the plans were approved and a conditional permit issued which is revocable when in the judgment of the State Commissioner of Health an appreciable pollution of the stream shall be caused or the operation of the disposal plant shall be unsatisfactory.

YONKERS

YONKERS, N. Y., *February* 21, 1907.

State Commissioner of Public Health, Albany, N. Y.:

DEAR SIR:—I present herewith drainage plans for a small section of the city of Yonkers with the drainage area of the sewers indicated thereon, together with the sewer plans adopted by the mayor and common council for the construction of a part of this small system.

These sewers are on the top of a high knoll and on account of the topography it is not possible to further extend them. Practically all the surface water to be cared for by these sewers now finds its way into the present system by flowing down the hills in the gutters of the highways and the additional storm water to be discharged into the Elm street sewer through these lateral sewers is unimportant.

Proposals have been received by the city for the sewer in Elm street, between Walnut and Alder, in Van Cortlandt Park avenue, in Spruce street and in Cliff street, but the awarding of the contracts has been laid over until Monday evening February 25th, so that we may first receive your approval.

I am authorized to say that this city proposes to observe the law requiring your approval of such sewers as we may build in the future and we ask your prompt and favorable action on the matters herein presented so that we may award the contracts next Monday evening at 8 o'clock.

These sewers are storm water sewers on the combined system, and I am able to inform you that the sewer system throughout the city is working well, is sanitary and gives our people and the authorities no trouble.

Yours respectfully,

S. L. COOPER,
Commissioner of Public Works

ALBANY, N. Y., *February* 23, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany. N. Y.:*

DEAR SIR: — I beg to state that plans for sewer extensions in the city of Yonkers were received on February 22, 1907, together with an application from the Superintendent of Public Works for the approval of the same.

These plans have been carefully examined by me and I beg to report in regard to them as follows:

The extensions of the present system of sewers for which plans are now submitted include sewers upon the "combined system" for a small district situated near the crest of the divide between the valleys of Saw Mill creek and of Tibbits brook. The combined length of the proposed sewers is about 4,500 feet and the point of entrance into the existing system is at the intersection of Elm street and Walnut street. The point of final discharge of sewage from these extensions is into the Hudson river near the central part of the city.

At the present time most, if not all, of the sewers of the city are upon the combined system and the proposed extensions represent the outer limits of extension of the present combined sewers in this section of the city. These extensions will amply provide for the sewage of the district included by them as well as for storm water, to the extent of about three inches of rainfall, according to the engineer, Mr. S. L. Cooper. The only questions for consideration then relate to a separation of sewage from storm water and provision for present or future purification of sewage.

In view of the fact that the present comprehensive system of sewers with which the city is provided, and of which the proposed sewers are extensions, are upon the combined plan and that these extensions can not well be further extended owing to topography, and the further fact that the increase of sewage that will be tributary to these extensions will be so small as to be almost negligible, I do not consider that, for these extensions, either a separation of sewage, or provision for purification, is practicable.

I therefore recommend that these plans for sewer extension in the city of Yonkers be approved.

Respectfully yours,

THEODORE HORTON,
Chief Engineer

The plans for sewers in Van Cortlandt Park avenue, Cliff street, Spruce street and Elm street were approved on February 27, 1907.

Plans for extensions in Stewart place, Stanley avenue, Romaine avenue, Elliott avenue, Thurman street and Rollins street were approved on April 23, 1907.

Plans for extensions in Ridge and Woodland avenues were approved May 29, 1907.

INDIVIDUAL PERMITS ISSUED DURING 1907, UNDER CHAPTER 468, LAWS OF 1903.

LOCATION.	To whom issued.	Date.	Waste matter.	Discnarged into	Remarks.
Alden	Frank G. Young	May 28	Laundry wastes	Tannery creek.	
Almond	Almond Union School	Aug. 26	Sewage	Canacadea creek.	
Auburn	Bowen & Quick	Jan. 3	Sewage	Owasco outlet	Permit issued for one year.
Central Bridge	R. E. Westcott	April 16	Creamery wastes	Cobleskill creek.	
Cohoes	Keyes Fibre Co	July 9	Factory wastes	Hudson river.	
Dover Plains	McDermott Dairy Co.	June 26	Creamery wastes	Church brook	
East Martinsburg	McDermott Dairy Co.	June 21	Creamery wastes	A small creek.	
Ellisburg	Dr. W. N. Halsey	June 21	Sewage	Sandy creek	Permit revocable when village sewers are installed so as to allow him to connect with same.
Greene	Page Seed Co	Aug. 19	Sewage	Chenango river.	
Greenport	Eastern L. I. Hospital Association	June 5	Sewage	Stirling basin	Permit issued for two years; issued on condition that screening of sewage shall be accomplished through screens having four meshes to the inch.
Greenport	Le Roy E. Raynor	June 20	Sewage	Sterling creek	Permit revocable when village sewer system is installed.
Hermon	Gaylord T. Chaney	Feb. 9	Sewage	Elm creek	Permit issued for one year.
Lakeville	Conesus Lake Creamery Co	June 12	Creamery wastes	Outlet of Conesus lake	Permit issued for one year.
Marion	J. B. Malcolm & Co	Aug. 8	Factory wastes	Marion creek.	
Merrickville	Beakes Creamery Co.	June 7	Creamery wastes	Carr's creek	Permit issued for one year.
North Olean	Vacuum Oil Co	Sept. 3	Refinery wastes	Two Mile creek.	
Poland	J. W. Brayton	Aug. 8	Sewage	West Canada creek	Sewage to be passed through sedimentation tank.
Richfield Springs	Walontha Knit'ing Co	Dec. 23	Factory wastes	Ocquionis creek.	
Rider's Mills	F. W. Rider	April 10	Sewage	Kinderhook creek.	
Willards	Willard Milk Station.	July 23	Creamery wastes	Chenango river.	

GENERAL INVESTIGATIONS RELATING
TO
SEWERAGE AND SEWAGE DISPOSAL

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AUBURN

During June, 1907, correspondence was had with the Board of Health of the city of Auburn, relative to a complaint received of the discharge of sewage into a ravine near Havens avenue.

On August 1, 1907, the following communication was received:

AUBURN, N. Y., *August* 1, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — Pursuant to your order in the matter of the Havens Avenue sewer, this Board was convened and an order was issued to the interested parties to cease draining into the gulley leading to Owasco outlet. Some of these parties are not in circumstances to comply with the order at once. We have obtained the consent of the complainant in the matter to an extension of time to about November 1st, and trust that this will meet your approval.

Respectfully,
THE BOARD OF HEALTH OF THE
CITY OF AUBURN, N.Y.
By B.

BAINBRIDGE

The following correspondence, relating to proposed sewer construction in Bainbridge presents a typical problem which often arises in relation to proposed sewer construction in villages. On the one hand is the private individual or corporation seeking sewerage facilities which will invariably improve the sanitary conditions of the locality. On the other hand is the State Department of Health charged by law to conserve the health of all the people of the State and of the community, and urging that sewerage improvements be carried out under official boards so that not only the needs of the entire community may be considered, but that the responsibility for the pollution of streams may be fixed on the proper, legal authorities who must eventually assume the expense entailed by treatment of sewage.

BAINBRIDGE, N. Y., *April* 5, 1907.

DR. EUGENE H. PORTER, *Commissioner State Department of Health, Albany, N. Y.:*

DEAR SIR:— Enclosed please find plans for the construction of a sewer line covering a portion of the streets of the village of Bainbridge. The part proposed to be built is indicated on the map by the lines platted thereon and between the points marked in red pencil "A to B" "B to C" "C to H" "D to H" and "H to J".

The other portions of the village covered by the map are not intended to be built at the present time and this map only covers a portion of the village.

The point marked " H " on South Main street is the last part of the sewer line in the streets and the portion from H. to J. being across private property, J. being the point of discharge which is in the Susquehanna river.

It is proposed that the discharge pipe be located about three feet under water and at this point there is a good current.

There are no residences along the line H. to J.

The distance covered by this proposed line is about 1,900 feet, and the portion of the line indicated by B to C being sparsely settled, there being but few residences along the same; in fact, there are but about thirty residences that could connect with this line and the main purpose of completing this line is to accommodate the public school building, in accordance with the requirements of the State Educational Department. The ordinary attendance of the school is from 250 to 300.

As you will see by the plan, it is anticipated ultimately that the other lines indicated on the map should be built. As I have previously stated, this covers but a small portion of the village but it is all that portion of the town that could be carried to the same point of discharge.

The company asking for this permit is a private company, possessing a franchise from the village to build sewer lines on such of the streets as sufficient patronage is offered to sustain the same, the village authorities and citizens not caring to afford proper facilities.

Very truly yours,
BAINBRIDGE SEWER COMPANY,
By JULIEN SCOTT,
Secretary

ALBANY, N. Y., *April* 22, 1907.

JULIEN SCOTT, *Attorney-at-law, Bainbridge, N. Y.:*

DEAR SIR:—I beg to acknowledge receipt of your communication of April 5th, accompanied by plans and profiles of proposed sewers in the village of Bainbridge.

By your communication, it is inferred that you ask, as Secretary of the Bainbridge Sewer Company, for the approval of said plans for sewers and the issuance of a permit for the discharge of sewage into the Susquehanna river.

With respect to the plans submitted, I would call your attention to the enclosed copy of rules for the preparation of plans for sewer systems, whereby you will note that in several respects the plans are not submitted in required form. The omissions are self-evident and are in regard to such points as duplicate copies, placing of sewer invert elevations on map, etc., etc. Plans submitted for approval should be drawn up in accordance with these rules.

Further, I would call your attention to an important point in connection with the submission of these plans for sewers to this Department for approval under the Public Health Law. This is the fact that the plans are not submitted by the village authorities but by a private company, and that, as far as the application would indicate, it is not intended that the village authorities shall either build the proposed sewers or maintain them after construction. This method of bringing about public improvements is not what was contemplated when the Public Health Laws were enacted, not only as respecting those sections or provisions relating to the approval by the State Commissioner of Health of plans for sewerage, such as chapter 414, Laws of 1897, but also as respecting the more recent amendments relating to the prohibition of stream pollution, such as chapter 468 of the Laws of 1903.

The experience of this Department has been that the construction of any considerable sewer or system of sewers within a village by private parties or by a private company, is a move in the wrong direction from both sanitary and financial standpoints when the public welfare is considered on general grounds.

With respect to the present plans, a decision as to the suitability of the design of the proposed sewer system or part of sewer system cannot be made until a plan of sewerage for the entire village is worked out. This is a matter which properly should be taken up by the village authorities and not by private parties or by a private corporation.

With respect to your statement that the village authorities and citizens do not care to afford proper facilities in the matter of sewerage, a reference to chapter 414 of the Laws of 1897, will show that a favorable vote could probably be had on a proposition to build the proposed sewers if, as may be aranged, only such sewers are proposed to be built which are desired by property owners who are willing to meet the assessed cost of such sewers.

The manner of assessment is optional with the sewer commissioners and the cost may be assessed wholly against the property benefited on a petition from the owners of two-thirds of the property fronting on the portion of a street or streets in which the sewer is proposed to be constructed. In this way, a petition to the village authorities to construct sewers in certain streets would undoubtedly be favorably acted upon, and such a proposition would probably be carried when submitted to the people at an election. The sewers, when thus constructed, would be in charge of the proper officials and be a part of a general, comprehensive system for the whole village.

I would urge you to take this matter up at once with the village authorities. It would not require a very great amount of additional engineering field work to supplement that already done to furnish data for a complete sewer map of the village, incorporating in such plan the present existing sewers.

Unless conditions are decidedly extraordinary and sewerage improvements can be brought about in no other way, it is the policy of this Department to disapprove plans for sewers to be built by private parties and to deny applications for permission to discharge sewage from such sewers into the waters of this State.

I am herewith returning map and profiles submitted. Trusting that the matter will be taken up by the authorities of the village of Bainbridge and assuring you that prompt attention will be given to plans presented by the village authorities, I am,

Very respectfully yours,

EUGENE H. PORTER,

State Commissioner of Health

BAINBRIDGE, N. Y., *May* 13, 1907.

EUGENE H. PORTER, M.D., *Commissioner State Department of Health, Albany, N. Y.:*

DEAR SIR: — Your recent favor, returning plans recently forwarded to your office for the sewer line for the Bainbridge Sewer Company, filed in your office, for the purpose of obtaining approval thereof, etc., received and duly noted. We also note the deficiency in relation to said plans, to which you call our attention.

In regard to the suggestions made therein, in relation to the fact that same are not submitted by the village authorities but by a private company, they have also been duly considered.

We agree with your contention that the village should own its sewerage and system but, on the other hand, we feel convinced that it is better that the system should be owned and maintained by a private company than to have no sewerage at all, which would be exactly the situation here. Efforts have been made for years to interest the village people in the proposition without avail. The proposition was agitated before we built the first line, which we now have in operation.

The proposed line is very much of a necessity. The State Education Department has demanded different sewerage facilities for the school buildings, and it is evident that they are required. Another proposition is just this: There is no possibility of the village building a line at the present time, and it either means that the local school district has got to build an independent line and maintain it at their own expense or, if permission is given to the present company to build the line, there are a few residences which could be connected with the line and help pay part of its maintenance.

As a business proposition there is no money in it for the company. However, as their other line does pay fairly well, they feel that they are merely bound to build this, inasmuch as it is obviously required, and it would seem that it would be a better proposition that they be allowed to do so and furnish sewerage facilities for the district at a reasonable compensation, in connection with the residences which could be served by the same line, rather than that the school district should be compelled to be to the expense entirely themselves.

We also disagree with your contention that such a move is a move in the wrong direction and our position is fortified by the experience had in this village. The first line was built by the company in reality for the accommodation of themselves, three of the four persons connected with the company being the owners of business property which required such facilities and, in fact, had to have them; I being the fourth to be united with them simply to help the cause along.

When the line was first built such property owners were practically the only ones that used it. Since its construction a majority of the people along the line have connected with it and have put conveniences in their houses that they had never thought of before. If the proposed line is built the same results will follow there and eventually, undoubtedly, a sentiment in the village could be created whereby the village could build its own line.

It has been our idea all the way through, and is now, that when such time came we would be willing to dispose of our property upon a proper basis to the village, and when I say a proper basis I mean one that would be just and equitable, and without any attempt to extort an exorbitant price from the village, which would be impracticable if attempted. We desire to construct the same with that idea in view so that it would be of sufficient dimensions to be comprised in the whole system for the village. I would also add that, owing to the peculiar location of the village, a complete sewer system would require three different outlets; one where the line is already built and one where the proposed line is, and the northern end of the village would have to have an independent outlet for the reason that the other outlets could not be adopted for that part of the village owing to the grade. The lay of the land is such that the north and south ends are higher than the middle but intervening between each is a hollow which precludes connections of the three parts.

As I have said before, it is absolutely useless to attempt to interest the village authorities in the proposition at the present time under these conditions and we believe the situation suggested in your communication exists, that is, that conditions are decidedly extraordinary and that sewer improvements could be brought around in no other way.

We would desire to have the proposition further considered and will prepare plans in accordance with the rules, except that we would ask to be relieved from presenting plans for the northern end of the village at the present time. and will furnish a certificate of the engineer certifying to the fact that it is impossible to connect the two. Our main object for wishing to be so relieved is the fact that there is the greatest necessity for prompt action as labor conditions are such that later in the season help could not be obtained here to make this improvement, and would request that you advise us if by furnishing such certificate and supplying the omissions upon the plans forwarded you, and otherwise making them comply with the rules of the Department, the matter would receive a reconsideration.

Very truly yours,

JULIEN SCOTT

BROWNVILLE

In response to numerous communications from a resident of Brownville, the Department on November 4th urged the board of trustees of the village of Brownville to construct a drain in Main street to care for cellar drainage.

BURDETT

In May and again in July complaints were received from a resident of Burdett that a drain constructed by the village authorities for the purpose of draining cellars on Lake street was clogged and the village authorities refused to repair the drain. The complainant was informed that since the drain received cellar drainage only, the matter must be settled between the property owners affected and the village authorities.

CORNWALL

In response to a request, a conference was held between officials of the village board and the board of health of Cornwall and the Engineering Division in relation to the installation of a sewerage system.

DOLGEVILLE

DOLGEVILLE, N. Y., *September* 14, 1907.

State Department of Health, Albany, N. Y.:

Inclosed find rules and regulations of Dolgeville sewer system. As health officer I am daily receiving complaints. The chief complaint I get is that no trap is permitted other than the fixture traps, then again just before the sewer enters the house an escape pipe is run up and out of the ground. This some claim allows all the noxious and foul gases from the main sewer to come out, often directly under an important window of the house. Then again the sewer from the street in is four inch, the vent pipe through the roof is two inch, this the plumbers, or some of them, say is not right. Now some one ought to *know* what is right. The health officer has never been consulted one way or another about anything in connection with the sewer system (which has just been completed) and it seems rather hard and unfair that he is now compelled to listen to all of these complaints. What shall I do? What ought to be done?

Very truly,

C. G. STROBEL,

Health Officer

ALBANY, N. Y., *October* 7, 1907.

C. G. STROBEL, M.D., *Health Officer, Dolgeville, N. Y.:*

DEAR SIR: — Replying further to your letter of September 14, in which you explain the unsatisfactory state of affairs in regard to plumbing regulations and request my opinion as to what should be done, I beg to say that the difficulty appears to be merely from the unusual custom in your village of having the board of sewer commissioners have charge not only of the sewerage system but also of the plumbing, the more customary practice being to place the plumbing supervision and inspection in the hands of the local board of health.

Since, however, the matter seems to be covered by rules, regulations and ordinances covering both sewers and plumbing, which with respect to the plumbing, are rather incomplete and not strictly in conformity with the best modern practice, and as the people seem to refer questions of plumbing to you, I will give you what suggestions I can in reference to your direct questions and also a few criticisms in respect to the regulations governing plumbing, a copy of which, dated 1907, is on file in this Department.

In reference to what is called the running trap and outside vent placed near the wall of the building, I would say that until recent years there has been some controversy as to whether this running trap should be used.

Some very good plumbing ordinances require the running trap, in which case the vent pipe leading just outside the building wall is placed on the soil pipe on the house side of the trap, the idea being to prevent any air from the sewer passing into the inside plumbing of any building, and the vent pipe allowing the entrance of pure air into the house soil pipe for the purpose of ventilating this soil pipe.

In the other system, where the running trap is not used, there should be no obstruction of any kind and the soil pipe should be carried full size through the house to a point above the roof and not in the vicinity of any windows or chimneys or other outside opening from the house.

This custom is the more general one in the best-written, recent plumbing ordinances since it gives a thorough ventilation to the entire sewage system, and, with the numerous openings thus afforded, the sewer gets so well ventilated as to have the air in the sewer and plumbing systems relatively pure and inoffensive. When this custom is followed, it is necessary that all fixtures within the house be properly trapped with "S" or bottle traps (better not with any mechanical traps since these frequently get out of order). If a trap is in a position such that there is any danger from siphoning, it should be "back vented" into the branch pipe from the main soil pipe which either leads independently to the roof or returns to the soil pipe.

If the latter method of plumbing is adopted *i. e.*, without running trap, it is very essential that no vent pipe be connected with the soil pipe near the foundation wall, since this, as you suggested in your letter, would allow the air from the sewer to come directly in the front lawn or under some window. This vent pipe, as stated above, is used only when the running trap is used and is then placed on the house side of the trap. Under no circumstances should the soil pipe at any point be less than four inches in diameter, nor should it be reduced in any way after passing through the roof, the end of which is usually protected with a cowl.

In general it might be well for your village to so arrange the administration of sewerage matters that at least the inside plumbing from a point just outside of the building foundation would be exclusively in the hands of the board of health since there are many questions affecting sanitation or public health which make it more desirable for the supervision and inspection of this plumbing to be in the hands of the board of health rather than the board of sewer commissioners, which, possibly, may not be familiar with these questions in reference to public health. Whether in the hands of the board of health or in the hands of the sewer commission, however, it appears from reading through the regulations that a considerable improvement might be made in them.

In the first place, plumbing regulations should be separate from those governing sewer construction. These regulations should also be very much more complete and cover many more points than those covered in the copy furnished me. In fact, I can suggest no better way to secure a better and more efficient code of plumbing regulations than to follow the pattern in other places where this class of engineering has been well developed and where the plumbing ordinances are good models. After securing a number of such codes, a careful study would reveal which one, with slight modifications would be the most desirable for the local conditions of your village.

If I can assist you any further in this matter, I shall be glad to do so.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

DUNKIRK

Dunkirk, N. Y., *June* 14, 1907.

Eugene H. Porter, Esq., *State Commissioner of Health,*
Albany, N. Y.:

Dear Sir: — Some time ago I received a communication from you in regards to a visit to Dunkirk, which letter was not presented to the board of health until the 13th instant, owing to a previous adjournment of its meeting on account of the death of **President J. T. Madigan.**

I am directed by the board to advise you that a visit to Dunkirk by Prof. Ogden, as you suggested, would be satisfactory and they would be pleased to have him come on a tour of inspection at his earliest convenience.

The board is also desirous of having you come to Dunkirk, and trust you may do so later on.

Kindly request Prof. Ogden to notify me whenever he can come to this city.

Yours very truly,
L. N. MURRAY,
Clerk

ALBANY, N. Y., *August* 6, 1907.

DR. G. E. ELLIS, *Health Officer, Dunkirk, N. Y.:*

DEAR SIR: — I enclose herewith copy of a report made to me by our engineer, Mr. Ogden, who has recently visited the city of Dunkirk and investigated certain nuisances existing in that city.

I desire to express to you and assure you and the board of health of the city my opinion that the sanitary interests of the city require the immediate construction of certain sanitary sewers as outlined in the report inclosed, and to repeat the statement of the report that this Department will not approve the discharge of house sewers into the creeks of this State whether these sewers are open or inclosed in masonry.

You should, in my opinion, begin the construction of sanitary sewers, just referred to, at once, and abate the present nuisance which exists from the flow of domestic sewage in the open gutters in the streets.

Respectfully yours,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *August* 1, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — I have the honor to report that on July 24 I visited Dunkirk in accordance with your directions and have to report the conditions as follows:

The city of Dunkirk has a population of about 15,000 persons and is largely dependent for its development on the Brooks Locomotive Works located near the center of the city.

The proportion of the laboring class is a large one and certain sections of the city are inhabited largely by a foreign population whose interest in sanitary matters must be cultivated but who, I was informed, are rapidly learning and already begin to appreciate the benefits of sanitary surroundings.

There are three streams which by winding channels find their way through the city from the south to the lake and which are more or less polluted by sewage and garbage. There has been a proposition to inclose these creeks and so convert them into drains or sewers into which both storm water and house sewage might discharge. This proposition has been submitted to the people and defeated by a heavy majority, largely, I understand, on the ground that certain individual land owners through whose property the streams flow would be especially benefited by the inclosure of the creeks since then by filling in above the sewer valuable land would be reclaimed.

I find that certain sections of the city are much in need of sewers, the domestic wastes running freely from the houses into the gutters where they are able to dissipate effluvia and may through the agency of flies or other insects contribute to the causation of disease.

I noted particularly the conditions on Armidilia street, each side of Pine street, on Martin and Jerboa street, and on Beaver street, as those indicating the immediate need of sewers.

I advised the health officer, Dr. Ellis, and the members of the local health board who explained to me the conditions, that the Department would probably not approve of the plans for walling in the creeks designed to receive house sewage, but that the Department would undoubtedly require the construction of sanitary sewers in the streets named and that there was no advantage in waiting for the question of the creeks to be settled since that question would not be involved in the matter of providing sanitary sewers in the streets named.

I also advised the local health board through those members present that, in my opinion, and I felt, that of the commissioner, when the facts were put before him, the local board would be fully justified in calling upon the city council for the immediate construction of sanitary sewers in the streets named above and in other streets where similar conditions exist, and I recommend them to take in some way immediate steps to abate the present nuisance.

I recommend that the policy of the Commissioner in the matter be expressed and that it be communicated to the mayor and to the health officer of the city.

Respectfully submitted,

H. N. OGDEN,

Assistant Sanitary Engineer

HOLLAND PATENT

An investigation was made for the purpose of advising the village authorities of Holland Patent as to the installation of a sewer system.

It was learned that a water supply system had been installed during the fall of 1907, and a letter was later addressed to the health officer calling attention to the fact that the installation of inside closets coming with the installation of a water supply system would tend to endanger wells in the gravelly soil of the village if the use of cesspools were continued, and that, therefore, the village should at once consider the installation of a sewer system.

MOHAWK

It was learned that the village of Mohawk had practically completed the sewer system approved by the Department, but had made no arrangements for the construction of the sewage disposal plant included in the plans.

Accordingly the following order was addressed to the municipal commission:

In the Matter of Sewer System
of the
Village of Mohawk.

Plans for a sewer system and sewage disposal plant for the village of Mohawk, Herkimer county, N. Y., having been heretofore and on February 7, 1905, submitted by the board of sewer commissioners of said village to the State Commissioner of Health under the provisions of section 260 of chapter 414 of the Laws of 1897 for his approval, resubmitted June 17, 1905, and July 3, 1905; And it appearing from an examination of said plans that a proper system of sewerage and sewage disposal was provided for, said plans were approved by said Commissioner of Health on July 6, 1905;

And plans having been submitted on August 25, 1906, for certain proposed changes in the sewer system, and examination of said plans having been made, such revised plans were approved by the State Commissioner of Health on August 25, 1906, duplicate copies of both said plans now being on file in the State Department of Health with the approval of said Commissioner attached thereto.

And it appearing that section 260 of chapter 414 of the Laws of 1897 provides as follows:

" The board of sewer commissioners of a village may establish and maintain a sewer system therein. Before taking any proceedings for the construction of a sewer, the board at the expense of the village, shall cause a map and plan of a permanent sewer system for such village to be made, with specifications of dimensions, connections and outlets or sewage disposal works. It may also include any existing sewer in the village. Such plan and map shall be submitted to the state board (department) of health for its approval and if approved shall be filed in its office. A copy thereof shall also be filed in the office of the village clerk. The map and plan may be amended, with the approval of the state board (department) of health, and if amended shall be filed in the same office as the original."

A complaint having been made to the State Commissioner of Health that the authorities of the said village of Mohawk are about to connect, or have connected, the said sewer system so as to discharge the sewage directly into the Mohawk river without such sewage passing into or through a sewage disposal plant, in direct violation of the provisions of law, above quoted, no permit therefore having been granted by said Commissioner of Health:

And it further appearing that such disposal of the sewage of said village would be injurious to the health of the citizens in this State, inasmuch as the waters are used for potable purposes; and in view of the fact that it is also in violation of section 75 of the Public Health Law, it is therefore hereby ordered

That no discharge of sewage from the said village of Mohawk into any of the waters of this State be allowed in any other manner than according to the plans previously approved by the State Commissioner of Health, which said plans include a system of sewage disposal; And the said village of Mohawk and its officers are hereby ordered and directed to allow or permit no discharge or disposal of the sewage of said village into any of the waters of this State other than according to the plans approved by the State Commissioner of Health, which include a sewage disposal plant as above stated; and the use of the said sewer system without the use of said disposal plant or in any other manner than that contained in the approval given is hereby forbidden as unwise and in violation of the provisions of the Public Health Law.

And further that any connections heretofore made in violation of the terms of the permit granted by the State Commissioner of Health, and the provisions thereof, be disconnected and discontinued therewith.

EUGENE H. PORTER,

Commissioner of Health

ALBANY, N. Y., *January* 28, 1907.

lly shows as follows:

rhereas pursuant to plans for a sewer system and sewage works heretofore duly filed with and duly approved by Commissioner of Health of New York State, to which erence is hereby made, and pursuant to due proceedings ccordance with the provisions of law in such case made ided, said village of Mohawk has made and constructed stem with the exception of the said disposal works and 00 feet of the trunk line sewer, which said portion of sewer is not completed because it is necessary to obtain of way through private property and to that end con-n proceedings are now pending.

he disposal works as set forth and shown on the plans nd as approved by the State Commissioner of Health been constructed by said village. That the said village unds with which to build and construct the same and of the indebtedness of the village it cannot legally con- indebtedness nor issue bonds in an amount sufficient to a disposal plant of the kind and of the size prescribed plans. That the estimated cost of the disposal works is the sum of $24,000 by the firm of Knight & Hopkins, ineers, of Rome, N. Y.

petitioners further show that the total assessed valuation eal property of said village as it appeared on the last r village assessment roll is the sum of $996,068, while so that to raise the money necessary to build the disposal plant as laid out on the plans the village would exceed the limitation of indebtedness, defined in the Village Law, as not to exceed ten per centum of the assessed valuation of the real property of such village as it appeared on the last preceding village assessment roll.

The sewer system as now constructed was installed under contract for the sum of $31,819.73, the engineers' bill amounting to $2,875. The sum of two thousand dollars is set apart for rights of way, and the cost of inspection amounts to $2,000; so that there is but a small margin left from the $40,000 realized for the building of the sewer system with which to meet the expenses for such extra work as is always incident to the final completion of a work of this nature and size, and therefore there is not any money realized from sale of sewer bonds to be used for said disposal plant.

Your petitioners respectfully submit that it would .be highly impracticable to attempt to raise said sum for the disposal plant .by the method of direct taxation against the village homes of our people, as the tax rate for the purpose of raising the necessary funds with which to meet the regular, necessary and ordinary expense of administering the affairs of the village in maintaining its streets, village cemetery, fire department, police department, paying interest on bonds and all other expenses incident to the orderly transaction of its municipal affairs, is and has been for some years about one dollar on a hundred dollars and for the future and until the streets and highways can be restored and made good from the bad condition resulting from the placing of sewer mains the rate will be higher still.

The total number of inhabitants of said village as shown by the official census of the year 1906 is only 2,063.

Your petitioners respectfully suggest, that because of the small population of said village and the probability of many householders not connecting with the sewer system for some time, that the proposed disposal works, as set forth on the approved plans aforesaid, are much too large to build at present for the use of said sewer system and that a much smaller and not so expensive a plant will meet every demand of the use of the sewers.

The growth of the village is very slow and there has been no material change in its growth and development for many years and your petitioners see no signs nor have any reason to believe that there will be any marked increase for some time to come. That the village lighting system has never been self sustaining and that only about 500 taps are in use in its water system the income from which, however, about takes care of its operating expenses.

It seems to your petitioners that if the matter of the sewage disposal works could be duly taken up and receive reconsideration and that plans for a plant be prepared which would be more in accordance with the real demands and needs of the situation that a just and equitable action would be extended to the village and that the best interests of all concerned would be conserved and properly safeguarded.

Your petitioners therefore pray that the village of Mohawk be allowed to build and construct a disposal plant in a manner and size to conform to the size of the village and its real present demands and in accordance with plans to be hereafter filed with and approved by the State Commissioner of Health, and at a time as soon as the necessary funds to build same can be provided and that pending the consideration and revision of the said disposal works' plans; and the providing of funds as aforesaid, that the said village be permitted and allowed to dispose of the sewage through an outlet of said system which shall be into the Mohawk river. That said sewer system can be used and operated for the use, benefit and comfort of the people of said village, upon the completion of said 1,000 feet of trunk sewer if the outlet of said system be into said river.

WHEREFORE your petitioners respectfully ask that an extension of time of three years be granted said village, within which it may be better able to construct a disposal works along the lines as suggested herein and as shall be directed and approved by the State Commissioner of Health and that it have all other relief and permission herein prayed for.

D. C. FORD,
J. G. RICHARDSON,
JAY BRACKETT,
F. B. CASEY,
Municipal Commission

—

STATE OF NEW YORK,
COUNTY OF HERKIMER.

D. C. Ford, J. G. Richardson, F. B. Casey and Jay Brackett, being duly sworn each and severally, deposes and says that he is a member of the Municipal Commission of the Village of Mohawk, that he has heard read the foregoing petition and knows the contents thereof; that the same is true to the best of his knowledge, information and belief.

D. C. FORD,
J. G. RICHARDSON,
JAY BRACKETT,
F. B. CASEY,

Sworn to before me this 15th day of
February, 1907.
JAMES E. RAFTER,
Notary Public

On March 4 a hearing was granted by the Commissioner to the Municipal Commission on the above petition.

ALBANY, N. Y., *April* 23, 1907.

The Municipal Commission, Village of Mohawk, N. Y.:

GENTLEMEN:—In the matter of your application for a modification of the size of the disposal plant for the village of Mohawk, as shown upon plans approved by this Department July 6, 1905, and for an extension of time before which sewage disposal shall be required by me, I beg to say that these matters have received my careful consideration, after having been submitted to our Consulting Engineer for study and report.

I enclose herewith a copy of our engineer's report, which embodies his conclusions as to a possible reduction in size and cost of sewage disposal plant, which was requested by you at a conference on March 4, 1907. This report also contains recommendations with regard to an extension of time for requiring of sewage disposal and as to the condition upon which any extended permit to discharge sewage into the Mohawk river should be issued.

This report with the conditions and recommendations contained therein I herewith approve and in accordance therewith I am issuing to you a permit for the discharge of the sewage from the sewerage system of Mohawk, now under construction and nearly completed, until January 1, 1910, under the conditions contained in said permit.

Respectfully yours,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *April* 5, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— In the matter of the application of the Muncipal Commission of the Village of Mohawk, Herkimer county, for a temporary permit to discharge raw sewage into the Mohawk river, pending the construction of a sewage disposal plant, I beg to report as follows:

Plans for a sewer system and sewage disposal plant were approved July 6, 1905. On August 25, 1906, a plan for a slight change in the route of the main outlet sewer was approved.

On January 29, 1907, after receiving information that the village sewer system was nearly completed and that no steps had been taken to construct a sewage disposal plant in accordance with the plans approved in 1905, the Department served notice on the Municipal Commission that discharge of raw sewage into the Mohawk river from the village sewage system would not be permitted.

On February 11, 1907, Messrs. D. C. Ford and J. E. Rafter, President and Attorney, respectively, of the Municipal Commission of the village, met the Commissioner at Albany and discussed the matter of application for permit. On March 4th, written application was made to the Department by the Municipal Commission for a permit to discharge raw sewage into the Mohawk river pending the consideration and revision of the approved plans for sewage disposal and the providing of funds for and the construction of the said sewage disposal plant.

At your request I have examined the approved plans of the sewage disposal plant with respect to their suitability and, at the request of the village authorities, also as to the economy of the layout.

I find that before final submission and approval in 1905, the plans were revised in that a longitudinal partition wall was added to the septic tank thus reducing its capacity to meet the objection of the Department that the time of detention would be too long for proper septic action. The facts in the case as presented in the designing engineer's report accompanying original plans warrant the decreasing of the size of the septic tank to economically meet the conditions which will exist when the plant is constructed. Although the plan of reducing the capacity of the tank by inserting a division wall will be effective, I find also that if this decrease is accomplished by diminishing the width of the tank a considerable saving in cost of installation will be accomplished.

As to the possibility of reducing the cost of the contact beds, it appears that the total area has been proportioned to only adequately care for the sewage that will be or becomes tributary to the system upon its completion. In fact, it is quite probable that if this plant is not constructed at the present time it may be necessary to enlarge it slightly when the time arrives for its construction. No saving, therefore, can be made by reducing the total area of the beds.

I find, however, that a decrease in cost may be effected by reducing the number of contact beds. This may be accomplished by leaving out four of the partition walls between beds. This will result in a saving in cost of the partition walls and a saving in cost by a reduction in the number of apparatus required for dosing the beds. In making this change the area of the beds would not, as stated above, be diminished but the operation of the beds will be much simpler and quite as effective.

The necessity, according to the plans, for pumping all sewage from an elevation of about 378. to an elevation of about 387. accounts for a large part of the estimated cost of the disposal plant. The construction of the disposal plant at a lower elevation, would do away with an annual expense for pumping as well as the cost of installation of pumping machinery and would result in a considerable saving, but it is evident, according to the evidence submitted by the engineers, that this is impracticable and that pumping facilities cannot be dispensed with.

It is my opinion then, that a revision of the plans with respect to capacity of septic tank and arrangement of contact beds might bring about some saving in cost of construction, and I would recommend that the village authorities confer with the designing engineers in this matter.

As to the question of extending the time before which sewage disposal shall be required, I would say first, that no evidence of a technical nature is necessary to show that the sewage of the village of Mohawk, when the system is completed and the sewage is discharged into the river, will pollute the water of the river in a manner and in an amount which, under existing circumstances, should be prohibited. In fact this prohibition should apply not only to Mohawk but to other cities and villages along this river which, regardless of their financial condition, should be dealt with in a manner similar to that above suggested for Mohawk and that they be required to remove the pollution which they now pour into this stream.

The Hudson and Mohawk rivers have for some time been known to be badly polluted. The question of its elimination has not only been the subject of investigation in the past, and in fact at present, but active steps have been and are being taken by the Department toward the removal of sewage from these rivers. Concerted action is impracticable and in fact might be impossible, for there are usually some municipalities which have not the financial means for carrying out the needed improvements.

The financial question is a very pertinent one in the case of Mohawk. The village has already experienced a series of municipal improvements including the construction of a modern system of sewerage in accordance with plans approved by this Department. According to the affidavits of the applicants these expenses have been heavy. To incur the expense of constructing a disposal plant at this time, which under local conditions and topography will be considerably more expensive than the cost of a similar plant under average conditions constructed elsewhere, will, it is affirmed, induce a heavy financial burden such as the village is unable at this time to meet.

The application prays that the time before which sewage treatment is required be extended by you for a period of three years, in the hope that the village will, during that period, have recovered from the expense already incurred in construction of a sewerage system, and, at the expiration of that time, will be better able to meet the expense of constructing sewage disposal works. Under the circumstances, I consider this request to be a reasonable one, and should recommend your granting it provided that, in the arrangement of the outfall works, precautions be taken to remove all visual pollution and to secure an effective mixing of the sewage with the water of the river at the point of sewage discharge.

To accomplish this removal of this visual suspended matter and dispersion of the sewage into the cross-section of the stream, I should recommend that at a point on the outfall sewer just before its discharge into the stream, a screening plant be introduced with meshes sufficiently fine to remove all of the coarse, and a considerable portion of the fine, suspended matters carried in the sewage. These screens should be constructed in duplicate or series, with the finest screens having a mesh not larger than one-eighth inch. They should be constructed so as to be easily cleaned and otherwise carefully operated. To accomplish dispersion of the sewage into the cross-section of the stream, it will be necessary to carry the outfall sewer out into the river, to or into the main channel, with the outlet submerged at the low water stage of the river.

In view of the foregoing, then, I should recommend that a permit be given the village of Mohawk to discharge sewage from their sewerage system into the waters of the Mohawk river until January 1, 1910, upon the following conditions:

First. That the discharge sewer be carried out into the channel of the river with its outlet submerged at low water stage.

Second. That a screening plant be constructed on the outfall sewer below all sewer connections, which shall be continuously maintained and operated in a manner that will effectively remove all visual suspended matters before the sewage is discharged into the river.

Very respectfully,

THEODORE HORTON,
Chief Engineer

PERMIT

Application having been duly made as provided by section 76 of the Public Health Law as amended by chapter 468 of the Laws of 1903, permission is hereby given to the Municipal Commissioners of the village of Mohawk to discharge sewage from the village sewerage system into the waters of the Mohawk river at Mohawk within the municipality of Mohawk in accordance with the plans accompanying the petition, under the following conditions:

(1) That the time of this permit shall be three years from the date thereof.

(2) That the discharge sewer be extended out into the channel of the river with its outlet submerged at low water stage.

(3) That a screening plant be constructed on the outfall sewer below all sewer connections and before said outfall sewer is operated, which will remove all visual suspended matter from the sewage before it is discharged into the river.

(4) That within two years, complete plans for sewage disposal showing amendments to present approved plans for sewage disposal shall be submitted to this Department for approval, provided such amendments shall be desired by the village authorities.

(5) That the village authorities having charge of the sewer system shall proceed with the construction of the sewage disposal plant at the expiration of two years from the date of issuance of this permit, unless, upon petition from said authorities, the period at the expiration of which the construction of said disposal plant shall be commenced shall have been previously extended by the State Commissioner of Health.

EUGENE H. PORTER,
State Commissioner of Health

ALBANY, N. Y., *April* 8, 1907.

NOTE.— This permit to become operative must first be recorded in the county clerk's office of Herkimer county, in which the outlet of the sewer, or in which the establishment is located.

OLEAN

Previous correspondence in the matter of sewer construction in the city of Olean will be found in the last Annual Report of the Department.

Albany, N. Y., *January* 2, 1907.

Hon. John F. Andrews, *City Clerk, Olean, N. Y.*:

Dear Sir: — In regard to the protest of the local health boa of the city of Olean that the city is about to construct a certai sewer in South Union street and that, in its opinion, this sewe would endanger the purity of the wells of the city's water supply located nearby, I have had the situation looked over by one of our engineers with especial reference to the sewer and wells.

Without going into detail as to the local situation, with which you are no doubt familiar, I would say that it is my opinion that if the proposed South Union street sewer be laid north to the Green street sewer, instead of south near the line of wells to the river, the possibility of contaminating the water supply will be avoided. Another end will also be served in that no new outlet for sewage discharge into the river will be created, and a greater concentration of the city's sewage will thereby result.

No report and map of the existing sewer system have been filed with the Department by your city, in accordance with the provisions of chapter 468, Laws of 1903. Nor have any plans or application for the proposed sewer now in question been filed.

You are therefore advised that the city authorities should at once take steps to comply with the provisions of the act in question and see that the report and plan of your entire sewer system is filed with this Department with as little delay as possible.

Your attention is also called to the provisions of the law requiring to be submitted to this Department all plans for additions or extensions to your existing sewer system for my approval before being constructed.

Under this provision, all plans for this sewer must be submitted to this Department and I would suggest that, in order to protect the driven well supply, the proposed sewer in question in South Union street be laid running north to Green street, instead of south to the river.

I trust that your city authorities will take this matter up at once and give it their careful consideration and I shall expect that all plans for sewer systems to be constructed in the city be filed in conformity with the law; and have no doubt but that I will secure your hearty co-operation in compliance with all the provisions of this act, to which you are respectfully referred.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

OLEAN, N. Y., *March* 18, 1907.

HON. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

SIR: — I have to acknowledge your communication of recent date regarding the filing of plans of the sewer system of the city of Olean.

I note that section 79 of the Public Health Law as amended by chapter 468 of the Laws of 1903, provides that this report is to be filed with the local board of health, and by it certified and transmitted to you. I have, therefore, filed the report with the local board.

This report contains two plans or maps: One showing the sewers actually constructed and in operation on the 7th day of May, 1903; the other showing the "sewer system" adopted by the common council of this city in its first municipal year (1893–1894). The charter of this city (Laws 1893, Ch. 478, § 98), provides as follows:

"As soon as practicable and during the first municipal year the Common Council shall cause to be made a general plan of sewerage which shall include all necessary main pipes for sewering said city and file a map and profile thereof in the office of the clerk of said city which shall be certified by said clerk to have been adopted by said Common Council, stating the date when such plan was adopted."

The same act (§ 90) provides as follows:

"Such sewer or drain may be discharged into the Olean Creek and Allegany River or either of them."

The position of the city of Olean is that it has a right under the provisions of its charter above quoted, and under section 75 of the Public Health Law as amended by chapter 468, Laws 1903, to complete the system or plan adopted under the provisions of the charter, although certain details or branches may not have been constructed and actually put in operation prior to May 7, 1903. Section 75 of the Public Health Law provides:

First, That no municipality shall discharge or cause to be discharged into the waters of the State without permission from the State Commissioner of Health any sewerage.

Second, That said section shall not prevent the discharge of sewerage from any such *sewer system* owned or maintained by a municipality provided such *system* was in operation at the time of the passage of the act.

Third, That the exceptions set out in the last paragraph above shall not permit any increase in the discharge of sewerage (which shall mean any sewerage) or from a *sewer system* which shall be extended, modified, or reconstructed subsequent to the passage of this act.

The position of the city of Olean is that the words "sewer system" used in the act refer to the complete system of the city and not to minor branches or details and that our system will not be, and has not been extended, modified, or reconstructed subsequent to the passage of chapter 468, Laws 1893, but that we are simply completing the system which then existed. The act itself shows a manifest distinction in the use of the word "sewer" and "sewer system." We have in our charter the express command of the Legislature to adopt a general system during the first municipal year, and its permission to discharge that system into the Allegheny river or Olean creek. The system was adopted and the outlets constructed. The plan provides for local sewers in all of the streets of the city which have been built from time to time and connected with the outlets, and we claim that section 75 of the Public Health Law did not intend to give the State Commissioner of Health the power to render valueless the entire system constructed, as a condition of complying with any regulations he might see fit to impose in order that we might be permitted to build such parts of that system as were not completed at the time section 75 took effect.

There is a small portion of the system adopted by the Common Council in 1893 and 1894 which has not been completed and we would be glad to have your views upon the construction to be placed upon section 75 of the Public Health Law with regard to the construction of the balance of our system. The part yet to be constructed consists of branches in certain sections of certain streets which will connect with the system already in operation, and our view of the matter is that if those branches come within the prohibition of that section then the connecting of any additional house to the sewer already in operation equally violates the section, because such connection would literally be an extension of the sewer, but as we read it, not of the sewer system, and we do not think that the construction of a branch which was provided for in the original plan and system is any more an extension of the system than the connection of a private dwelling to the one already built.

Respectfully yours,
E. D. WESTBROOK,
Mayor

ALBANY, N. Y., *April* 18, 1907.

HON. E. D. WESTBROOK, *Mayor, Olean, N .Y.:*

DEAR SIR:— I have a communication from you with reference to filing the plans of a sewer system for the city of Olean.

The questions involved have received my careful and earnest consideration and I have gone over carefully the legal questions raised by you. Without attempting to express an opinion as to the apparent conflict between the Public Health Law and the act of the Legislature under which your sewer system was constructed, I beg to say that as to the small parts of your sewer system which have not yet been completed, I hardly think it would be wise or in the interests of the public generally for this Department to attempt to raise any question about them.

Without attempting to bind the Department in the future to any action, I would simply say that as to the minor portions of this sewer system which have not been completed, it is not my intention to raise any objection about their construction. While I am charged by law with the duty of enforcing to the utmost the provisions of the Public Health Law, I am convinced in this case that the interests of public policy would best be served by not attempting to dispute the completion of the plans for your sewer system.

As to plans for additions and extensions of this sewer system, I am forced to take the position under the Public Health Law, that they should be submitted to this Department in the future before being adopted or constructed and I must, therefore, ask and require you to see that this is done.

I wish to thank you for writing me so fully in the matter and assure you of my interest in the sanitary conditions of your city and trust that my action in this matter may be entirely satisfactory to you and to the other officials charged by law with the control of the sewer system.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

ONONDAGA COUNTY HOUSE AND HOSPITAL

An inspection was made and advice given as to means for sewage disposal for the Onondaga County House and Hospital.

PATCHOGUE

ALBANY, N. Y., *May* 8, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR: — I beg to report that on May seventh I visited Patchogue, in accordance with your directions and in response to requests of the health officer of Patchogue, to confer with him in regard to the question of water supply and sewerage.

I met Dr Overton during the morning and spent the remainder of the day going over the ground, inspecting sources of pollution of streams, inspecting the condition of existing sewers and studying the general lay of the ground in regard to an appropriate system of sewage collection and sewage disposal. In the evening, at the request of the president of the board of trustees and president of the board of health, I attended a special meeting to discuss the general matter of sewerage and sewage disposal and give them my views in regard to this important problem.

In my talk at this meeting I explained the excessive pollution of the ground soil in Patchogue, where, during the summer, there is a population of some 10,000 people on the area of about one and one-half square miles, and where the sewage of this population is at present being taken care of in a large measure by cesspools. I further explained to them that the private sewers they now have discharge into the Patchogue river in violation of the public health law and that this is an added reason for the introduction of sewerage and sewage disposal.

Plans have already been prepared in rough outline for a system of sewerage and sewage disposal by different parties, and since these plans are somewhat at variance as to the general method of solving the problem, I recommended that they refer the plans to a good consulting engineer for a choice as to the best method of collection to adopt as well as for the best method of sewage disposal. I also suggested that if either of these plans are to be worked up in detail by the local engineer, the Department would give every assistance so far as seeing that they conformed to the general requirements which would be necessary to receive your approval.

The principal question to be considered by the village authorities and the public is as to the necessity of a sewerage system at this time. I unhesitatingly pointed out the need for such a sewerage system under the present local conditions which exist at Patchogue and recommended that plans at once be prepared showing such a system with proper sewage disposal. These plans will, of course, be submitted to the Department when completed and the construction and operation that is required for the present time started without delay. The village is about to introduce an extension to their present waterworks system, which I explained was an added reason why improved sewerage should be introduced simultaneously.

The results of my visit were apparently satisfactory in every regard and there is nothing further for this Department to do until further assistance or information is requested by the local authorities of Patchogue.

Respectfully yours,

THEODORE HORTON,

Chief Engineer

POCANTICO HILLS

At the instance of the New York city authorities, an inspection was made of the sewage disposal system installed at St. Joseph's Normal College at Pocantico Hills, Westchester county.

As a result of the inspection a letter was addressed to the college authorities advising that certain contemplated improvements should be made to the plant. The correspondence in the matter follows:

ALBANY, N. Y., *June* 20, 1907.

BROTHER JULIAN, *St. Joseph's Normal College, Pocantico Hills, N. Y.:*

DEAR SIR:— This Department is in receipt of a complaint as to the working of the sewage disposal plant connected with the St. Joseph's Normal College and the Department has caused an investigation to be made of the same.

I am informed by our inspector that the sewage from the college is causing a small stream which flows into the Pocantico river to be polluted by the sudden discharge of large volumes of sewage coming from the irrigation field.

I am informed that you have under contemplation certain improvements and different methods of maintenance of the irrigation field, and that you are proposing to distribute the tank effluent over the field in a less concentrated fashion, and that this work is under the direction of a competent sanitary engineer.

Under these circumstances, I do not feel like making any recommendations to you as to the propriety or impropriety as to the improvements suggested, but must emphatically point out to you the necessity of improving the character of the effluent and entirely doing away with the nuisance now created by the pollution of this tributary of the Pocantico river.

Respectfully yours,

EUGENE H. PORTER,
Commissioner of Health

NEW YORK, *June* 25, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — Referring to your letter of June twentieth, addressed to Brother Julian, St. John's Normal College, Pocantico Hills, N. Y., which has been referred to us. This relates to an examination recently made by your inspector of the sewage disposal system in use for that institution, in which he found that the sewage was not being uniformly distributed over the irrigation area, but that the flow was concentrated and ran to the foot of the slope, where there was a possibility that it would get into a small stream which flows into the Pocantico river.

At the time your inspector made this examination our engineer was there and was already proceeding to rectify the trouble. The repairs have been completed, and a recent examination made by us shows that they have accomplished the desired result.

The cause of the trouble, briefly stated, was as follows: We designed and supervised the construction of this disposal system, plans for which were approved by your Board. The work was completed late last fall and came into use in October. The irrigation tract had been carefully graded to a uniform slope, but the grading had left the ground soft and liable to wash, and the grass seed which was sowed to prevent this wash did not have time to take root before the sewage was discharged on the irrigation tract, and as winter soon set in a strong growth of grass could not be secured. The result of this was the formation of slight gullies through which the sewage ran to the foot of the irrigation tract, instead of being distributed over it.

All these gullies and depressions have now been graded up, and the sewage has been made to spread over the surface as was originally intended.

Will you be kind enough to appoint a time when your inspector can make another examination, so that our engineer can meet him on the ground, and we will also have a representative of the college there to look over the work and see that it is operating properly.

Very truly yours,
WARING, CHAPMAN & FARQUHAR

PORT CHESTER — RYE

PORTLAND, MAINE, *September* 17, 1907.

E. H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:—In accordance with your request, I have the honor to submit herewith a statement of the existing conditions connected with the sanitary drainage of those portions of the village of Port Chester and of the town of Rye, known as Washington Park, and concerning which complaints have repeatedly been made by the board of health of the village of Rye.

On November 22, 1905, Mr. Charles E. Brugler, president of the board of Health and Dr. B. J. Sands, health officer of the village of Port Chester, had a conference with you in your office in New York city, and according to your suggestion, Dr. Sands, on March 1, 1906, made a complete report on the existing and desirable sewers for the village. He pointed out at that time that Washington Park, which is rapidly growing, and is inhabited by Italians almost exclusively, lies partly in the village of Port Chester and partly in the town of Rye, the latter portion being the lower. He suggested that for the complete drainage of the district, which is separated from the rest of the village by a ridge. so that the natural drainage of the district is westerly through the village of Rye, a tunnel should be constructed through the ridge, starting from the lowest point of the district in the town of Rye and discharging into the Byram river within the limits of the village of Port Chester. He points out further that such concerted action on the part of the village of Port Chester and the town of Rye should also be joined in by the village of Rye, since a certain part of that village could most readily be drained by this tunnel.

Under date of April 7, 1906, Mr. H. B. Cleveland, Engineer of the Department, reported the results of his inspection of the conditions, and suggested that the economy and efficiency of the tunnel sewer should be compared with a separate disposal plant, whose effluent might be discharged into Blind brook, the pollution of which is now the cause of the many complaints.

It appears that one of the local attorneys advised the village of Port Chester that such a combination of interests as was proposed could not be legally entered into and the construction of the tunnel was therefore not undertaken, as being both too expensive for Port Chester alone and as being insufficient for the complete drainage of the entire district.

On March 25, 1907, a year later, Mr. Charles Greer, the owner of a fancy stock farm through which Blind brook flows, in the village of Rye, complained to this Department that a certain soap factory in Washington Park in the town of Rye polluted the brook and asked that the department abate the nuisance. The receipt of the complaint was acknowledged on March 28th, and a letter written to Mr. E. F. Studwell, president, town board of health of Rye, asking him to look into the matter and take suitable action.

On April 1st, Mr. Studwell replied, enclosing report of Dr. D. C. Loewenstine, health officer, both letters disclaiming any responsibility for the nuisance, which they stated was due to domestic sewage from houses in Washington Park in the village of Port Chester.

The matter was then referred to Mr. John H. Vogt, inspector of the Department, who reported on April 11. He stated that while the soap factory contributed toward the pollution of Blind brook, the chief cause of the pollution and the probable reason for the complaint of Mr. Greer consisted in the large amount of sewage from Washington Park.

Under the same date Mr. A. P. French, editor of the Port Chester Daily Record, advised you by letter that in his opinion, the construction of the proposed sewerage tunnel would be, in his opinion, a wilful waste of money, since the natural drainage was along the line of Blind brook.

On April 17, Mr. Greer was advised that the inspector's report showed a complicated situation which had been referred to the consulting engineer of the Department, and that he would be further advised upon the completion of that report.

On April 23d, Mr. Brugler, president of the Port Chester Board of Health, wrote you asking for an appointment to confer on the matter of the Washington Park sewerage, which was answered by a letter under date of May 1st, making the time of conference depend on the completion of the report of the consulting engineer.

April 29th, Mr. Greer wrote again impatiently asking when he might expect some action to be taken by the Department.

On May 7th, Mr. Greer telegraphed asking for a reply to his letter of April 29th, the receipt of the telegram being acknowledged by letter of the same date.

On May 7th, Mr. Vogt forwarded a letter from Mr. John E. Wyman, complaining of the soap factory, but again expressing his opinion that the nuisance was due to the sewage of Washington Park. Mr. Vogt also recommended that the plan of the construction of a tunnel be abandoned and that two sewer districts be formed, one for that portion of Washington Park in the village of Port Chester, and one for that portion in the town of Rye, and that each district have its own sewage disposal plant, the effluent of both discharging into Blind brook.

On May 15th, the consulting engineer reported that under the conditions, it seemed advisable to construct a system of sewers for Washington Park, and that the Department could do little or nothing in the matter until such sewers were built.

On August 12th, Mr. Waldron Williams, president of the board of Health of Rye, telegraphed the Department at length, complaining of the discharge of sewage from Port Chester, into Blind brook, and asking for immediate action by the Department. He sent a letter of same date explaining that the soap factory pond was very foul and was discharging into the brook, that the Washington Park sewage was very objectionable and asking that a representative of the Department be sent to Rye at once.

This telegram was acknowledged by telephone and the health officer of Port Chester written to on August 21st, asking for the status of the proposed sewers for Washington Park, the condition being such by previous reports that it seemed impracticable for the Department to take any action in the matter. Since August 12th, Mr. Williams has written several letters complaining of the inaction of the Department.

On September 14th, the writer at your request visited Rye and inspected the locality with a view of determining what jurisdiction and authority, if any, the Department had in the matter. I find that the conditions have been truly represented by the inspector and by the health officers who have reported to you heretofore. The village of Rye has no sewer system, and I found several private sewers discharging into Blind brook within that village, and the supervisor of the village intimated that it might be some time before the village would begin construction, although plans for a sewer system for Rye village have been approved by this Department, and the village has legislative authority to issue bonds for the expenses connected therewith. I cannot but feel that under those circumstances, any attempt by residents of Rye to prevent the pollution of a brook by Port Chester when they are themselves contaminating the brook is ill-timed.

I find that a considerable contamination comes from the Italian settlement in Port Chester, but another large part comes from that part of the settlement in the town of Rye. It would therefore only partially remove the cause of the nuisance to have the sewage from Port Chester purified.

The methods of caring for the sewage of the district are, as pointed out by Mr. Cleveland:

First, A tunnel outfall to Port Chester harbor, suggested, I understand, by Mr. F. S. Odell, in reports made to the village of Port Chester in 1904.

Second, An outfall sewer approximately along the line of Blind brook, to become a part of the Rye system of sewerage when that shall be built.

Third, Small and separate disposal plants for the village of Port Chester and the town of Rye, as well as for the village of Rye, should the latter develop in this vicinity.

Fourth, Suggested by Mr. Cleveland, that the district as a whole build a sewage disposal plant, discharging into Blind brook.

I am of the opinion that without doubt the last solution is the proper one, since the sewage, after passing through the tunnel, ought to be purified before discharge and such purification might better take place where the cost of the tunnel will be avoided.

I am informed by the health officer of Port Chester that the village stands ready to follow the advice of the State Commissioner of Health in the matter, but that without doubt, the village of Port Chester will annex the whole of Washington Park shortly and then a sewerage system for the whole district can be taken up properly and successfully, and I am of the opinion that his statement is reasonable and made in good faith.

At the time of my visit there was no public nuisance in the stream in the vicinity of the property of Mr. Greer, the complainant, nor was the condition of the stream at any point a menace to life or health.

I recommend, therefore, that Mr. Williams be informed, that, after a careful consideration of all the facts, the Department, under the provisions of the Public Health Law, has no authority to compel the village of Port Chester and the town of Rye, either separate or united, to construct and operate a system of sewers in the district of Washington Park, although it is convinced that the sewage from that district is discharged into Blind brook, thereby contaminating the same.

I recommend also that the health officer of Port Chester, Dr. B. J. Sands, and the supervisor, Mr. E. F. Studwell, be advised that the Department feels that action in the matter of providing sewers for Washington Park cannot be long postponed and that they be encouraged to take such steps as will either annex that portion of Washington Park in the town of Rye to the village of Port Chester, or will secure legislative permission to form a sewer district of the same territory, in both cases for the purpose of the construction of a sewerage system and a sewage disposal plant discharging into Blind brook.

Respectfully submitted,
H. N. OGDEN,
Acting Chief Engineer

ALBANY, N. Y., *October* 7, 1907.

Dr. E. H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— We, the undersigned, beg to report, that on September 28th, we visited the village of Rye, and, in company with Mr. William B. Bird and Henry W. York, members of the board of health of the village of Rye, went over the territory lying partly in the village of Port Chester and partly in the town of Rye, known as Washington Park.

The discharge of sewage and the overflow from cesspools located in this district finds its way into Blind brook, which flows through the village of Rye.

The pollution of Blind brook is seriously objected to by the residents of Rye and repeated communications have been addressed to this Department by the local board of health complaining of this pollution.

You have, as you know, urged the village of Port Chester to sewer the said district but action which might have removed the pollution from Blind brook, either by diversion of the sewage or by the construction of a sewage disposal plant, has been hindered by reason of the fact that two separate municipalities were concerned — the village of Port Chester and the town of Rye.

The report of Assistant Sanitary Engineer H. N. Ogden in the matter, dated September 17, 1907, reviews the case fully.

It was learned during our visit, at a conference between the inspecting party and Mr. Charles E. Brugler, president of the Port Chester Board of Health, that the legal powers of the Department and of the town and villages in the State were little understood regarding the construction of sewers, and we would recommend that letters be addressed to the boards of health of the three municipalities concerned in the matter, containing a full statement of the situation, in an effort to clear up the questions involved and further, that a joint conference be held between yourself and the three boards of health for the purpose of determining upon some procedure which shall remove the cause for complaint.

Respectfully submitted,
A. H. SEYMOUR,
Secretary
H. B. CLEVELAND,
Assistant Engineer

As a result of a conference held between the Department and the boards of health of the town of Rye and the villages of Port Chester and Rye, the following letter was addressed to Mr. Waldron Williams, president, board of health of the village of Rye, to Mr. Edwin F. Studwell, president, board of health of the town of Rye and to the Rev. Charles E. Brugler, president, board of health of the village of Port Chester:

DEAR SIR:— At the joint meeting of the boards of health of the town of Rye and the village of Port Chester and Rye, held at Port Chester on the evening of November 7, 1907, I was requested to submit to each of the three boards of health represented at the meeting a report embodying my views and recommendations as to the most expedient course which should be pursued by the respective communities in order to effectually eliminate the pollution of Blind brook and of any nuisance arising therefrom.

I take pleasure, accordingly, in presenting to your Board my views in this matter. I hope these suggestions will not only assist you in comprehending the seriousness and scope of the problem before you, in indicating the lines along which a solution of it is possible; but that they will also indicate clearly the responsibility and duty of the three municipalities in taking concerted, if not joint action to remove the pollution of this stream.

It appears from the records and correspondence in this office that the matter of pollution of Blind brook has during the past two years been the subject of numerous complaints by the village of Rye and of repeated inspections and reports by officials of this Department. The results of these inspections show clearly that Blind brook is polluted by the direct discharge or overflow therein of sewage from private sewers, cesspools and other sources for nearly its entire course, and that each of the three communities are to a greater or less extent parties to this pollution.

As generally happens in the case of a joint pollution of a stream by a number of municipalities, the community situated lower down upon a stream, which in this case is the village of Rye, is more seriously affected by any insanitary influences arising from this pollution; but this in no way lessens the significance of the fact that the village of Rye is at the present time a party to an equal or greater extent with the other communities, in the total pollution of Blind brook, and a consequent equal or greater violator against the Public Health Law forbidding this pollution.

So evident is the responsibility of the three communities in the matter of joint pollution, and so equally evident is it the duty of the three communities to co-operate so far as is practicable in any action that will result in the elimination of this pollution, that no further consideration will be given at this time to the question of responsibility, nor, in fact, to any phase of the question not bearing directly upon the solution of the real problem before you, viz.: the most expedient course of action to be followed by each community that will result in the removal of this pollution from the stream.

The question is unfortunately somewhat involved, from a legal standpoint, owing to the geographical and topographical relations of the three corporate divisions. The boundary lines of the three corporations cross the area tributary to Blind brook in such a manner as to cause the natural drainage to flow from the area of one community onto that of another. That is, the brook in its course through the northerly end of the town of Rye passes near the westerly line of the village of Port Chester, but it does not touch this line, and the consequence is that the natural drainage from the portion of Port Chester tributary to Blind brook must cross onto and through the land in the town of Rye before reaching Blind brook. Then again the stream itself below the village of Port Chester crosses into the village of Rye so that the natural drainage from both the town of Rye and the village of Port Chester must cross onto and through land of the village of Rye.

Let us leave for the time being, however, the legal questions involved and consider the more important question of engineering — important because of the expense involved and to be met by these municipalities for the necessary improvements. In general we may say that means for the collection or interception of sewage in any populated area or district should, on grounds of economy in cost of construction and maintenance, be developed along the lines of natural drainage of the territory in question. In other words, intercepting sewers should, in general, be constructed along the axis or main streams of any drainage area, and should generally be designed to sewer the population adjacent and tributary thereto. It is only wise to deviate from this course when the boundary lines between the civil divisions are definitely fixed beyond possibility, or at least probability of change in the future, or where suitable means of disposal cannot otherwise be accomplished.

The natural drainage of the territory in the three civil divisions under consideration is along the course of Blind brook. The boundary lines between these civil divisions are unquestionably not so fixed as to preclude the possibility nor even probability that they will be changed in the future. The sanitary conditions surrounding Blind brook are such that all three communities must at once, or at an early date, either individually or jointly, remove the pollution contributed by them. In fact from every standpoint it appears wise, if possible, for these communities to ultimately act jointly in the matter of interception and removal of the pollution of Blind brook.

It is, on the other hand, possible from an engineering standpoint to dispose of the sewage of these three communities independently, the wisdom of which must depend upon the power of the three civil divisions under the statutes to act jointly in such a matter, and the relative cost of individual disposal as compared with joint disposal, provided a joint action were found possible. That joint action is possible, if found desirable by all three communities, seems hardly to be doubted, even if it be found necessary to secure special legislation.

As to the question of cost of joint as against individual disposal, this can only be definitely settled by careful estimates of costs of the two methods. An estimate of the cost of joint disposal is a simple matter of engineering and should be easily made by a competent engineer within reasonably close limits. These estimates can, of course, be made only after a careful study and design has been prepared of an intercepting sewer paralleling Blind brook for the purpose of intercepting the sewage from the tributary districts in the three communities, and leading to a suitable point of disposal below the village of Rye.

An estimate of the cost of individual disposal, though not so simple, is however equally determinable. It is possible, for instance, for Port Chester alone, or in conjunction with the town of Rye, to convey the sewage tributary to Blind brook through a tunnel to some convenient and adequate point in the present sewerage system of Port Chester. Again, it is possible to pump the sewage across the divide, instead of conveying by gravity through a tunnel, to the same or other appropriate point of the Port Chester system. It is further possible to treat the sewage of these two communities by individual or joint sewage disposal plants, located at some suitable point near the brook, and discharge the purified effluent into the brook.

With the sewage of the town of Rye and village of Port Chester taken care of by one of the methods just outlined, it would then devolve upon the village of Rye to dispose of its sewage independently. This could be accomplished by the construction of sewage purification works suitably located near the brook below the village of Rye, or by other methods of satisfactory disposal.

It is evident from what has been said that a definite solution of this problem can only be reached after a careful study by a competent engineer of the possible means, arrangement and estimated cost for the disposal of the sewage of these three places; first, upon the collective plan and then upon the individual plan. From such a study and after carefully balancing the cost of disposal according to each plan, with due consideration of the benefits to be secured, it would be a simple matter to conclude what procedure would be best for each of the municipalities to follow.

It might be noted in passing, that if the town of Rye should construct a sewer and disposal plant near Blind brook, just above the village of Rye, it would be possible under the Village Law, chapter 414, section 276, for the village of Port Chester to contract with the town of Rye to receive and dispose of any sewage from sewers constructed within the village of Port Chester. This, of course, would not remove the sewage pollution from the village of Rye, a matter which, however, the village of Rye can and perhaps, has taken up in connection with the completion of her present system of sewers now under construction.

In view of the foregoing, then, I would recommend the following as the steps that should be taken by the proper authorities of the three communities interested, either individually or jointly, in order to arrive at a more definite solution of this problem, and to enable them to proceed along lines that will lead to definite practical results:

1. To engage the services of a competent sanitary engineer to study and determine the relative feasibility and economy of disposing of the sewage of the three communities upon the individual plan, and upon the collective plan according to the different methods and arrangement suggested above.

2. To determine whether joint action on the part of the three municipalities is desired by all, or by any two of them, in case the studies of comparative cost indicate that a joint action is the most expedient.

3. In case it is decided that the best interests of the three communities can be served by joint action, to appeal to the Legislature for the necessary authority to construct works according to this plan.

4. In case the engineering studies, or other reasons, indicate that individual disposal for each community, or joint disposal in the case of Port Chester and the town of Rye, which seem to have closer natural relations, is the more expedient course — to have an engineering study made of the most practicable and economical method of disposal. The questions involved in this case will, in general, be more simple than in the case involving the three communities, and can be settled more easily by engineering studies alone. In the case of individual disposal for each of the three communities, it would not be necessary to appeal for special legislation, and in the case of joint disposal for Port Chester and the town of Rye, it is also possible, as outlined above, that special legislation may not be required.

I would urge then as my final opinion in this matter, that unless or until these three communities which now pollute Blind brook pursue a rational and reasonable course of determining, along the lines suggested above, what is the most expedient and economical means of intercepting or otherwise disposing of the sewage now entering Blind brook, and in taking definite action in accordance therewith, I can see no hope of a betterment of the sanitary conditions along Blind brook except through the slow, laborious and expensive means of legal action. Such action is not, in my opinion, justified at this time, in view of all the circumstances in the case, and I believe that recourse to such action would in all probability terminate in a course of procedure similar to what would be followed without any recourse to such action.

I regret that in this particular case my duties and powers under the Public Health Law do not enable me to take further action in the matter, and I earnestly hope, in view of this fact and the suggestions offered, that such voluntary and speedy action will be followed by the authorities of these three municipalities as will effect an early and satisfactory solution of this vexatious problem.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

RICHFIELD SPRINGS

At the request of the village authorities, Assistant Engineer Cleveland of the Department visited Richfield Springs, and advised the village board with reference to the reconstruction of the main outfall sewer.

SEA CLIFF

ALBANY, N. Y., *April* 4, 1907.

H. G. WAHLIG, M.D., *Health Officer, Sea Cliff, N. Y.:*

DEAR SIR:— Replying further to your letter of February 26th, in which you request my opinion in regard to the plans for sewage disposal of Sea Cliff, which were approved by this Department in 1897, I beg to say that I have had our consulting engineer review these plans and enclose herewith a copy of his report to me in regard to them, with the suggestion that modification be made in these plans in accordance with the recommendations contained in his report.

If there is any further information which I can give you in regard to either the plans or Mr. Horton's report, I should be very glad to do so.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *April* 4, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— In the matter of the plans for sewage disposal of Sea Cliff, Nassau county, which were submitted and approved by this Department in 1897, and the request of the health officer of Sea Cliff for your opinion as to whether these plans are still acceptable, I beg to report as follows:

The original plans as approved show a method of disposal by chemical precipitation. The disposal plant has not up to the present time been constructed. During the interval that has elapsed since the approval of these plans, however, considerable progress has been made in the art of sewage disposal, and whereas the plans as originally approved were at that time considered an appropriate method, they can hardly be so considered at this time in the light of our present knowledge.

Chemical precipitation does not give on the average more than fifty per cent. purification of the sewage, and the method is not now considered to be a complete one for the disposal of sewage. It is used abroad to considerable extent as a preliminary treatment, but owing to its low efficiency and high cost of operation, due to the expense of chemicals, and owing further to the difficulty of satisfactorily disposing of the sludge, this method has been superseded by better and more effective processes of sewage treatment.

In the case of Sea Cliff, I am of the opinion that it will be to the better interest of the village to adopt some other method of purification than that of chemical treatment, notwithstanding the fact that the plans have already been approved by this Department. There are other methods of disposal now successfully in use that are more efficient and economical, as, for example, the septic tank followed by filtration by either the slow sand type, or the more rapid filters of contact or sprinkling type.

I would then recommend that the village of Sea Cliff abandon the plan of treatment by chemical precipitation and employ a competent engineer to prepare new plans involving the more modern type of sewage disposal works, as above suggested.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

On April 17th a request was received for inspection and advice in the matter of the disposal of the contents of cesspools and privy vaults as well as the matter of the establishment of a sewer system.

An inspection was made and a letter of advice transmitted to the board of health.

SENECA FALLS

ITHACA, N. Y., *June* 1, 1907.

DR. E. H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Replying to your letter of May 29th, in the matter of the construction of the septic tank in connection with the sewerage system for the village of Seneca Falls, I have to advise you as follows:

I visited the village on this date and conferred with the engineer, Mr. H. J. Morrison, and with the chairman of the sewer commissioner, Mr. Sidney Smith, and both men were quite frank in acknowledging that they were not expecting to build the septic tank at present. The reason for this failure to comply with the conditions under which the plans were approved, seems to be that they are unwilling to go to the additional expense. They state that the funds available for construction are barely able to meet the needs of the pipe system, and that they will be obliged to submit the matter of additional money to a popular election.

They represent that there is no town nearby which would be affected, and that there is but little danger of any annoyance being caused by a direct discharge of the sewage into the river.

The contractor is rapidly laying the pipes, and while the contract calls for the completion of the work by the first of July, it does not appear likely that the work will be finished by that time.

The twenty-four inch outfall pipe is to be laid, they assured me, although they acknowledged that the pipe for that portion of the system had as yet not arrived, this portion being postponed, they told me, on account of difficulties with the right of way, now amicably settled.

The chairman proposes to address you in the matter, asking if they may be allowed to postpone the construction of the tank for a year or so, trusting that it will be easier to raise money for this purpose at some later date.

As you know, the village is in litigation over the question of water supply, and it is my opinion that it would be wiser to insist on the septic tank construction now, rather than to wait until the village funds are diverted into waterworks construction. I could find no reason, except a reluctance to incur the expense if it could possibly be avoided, which would not be equally valid next year or the year after, and therefore, I believe that no extension should be granted the village.

Yours respectfully,

H. N. OGDEN,

Assistant Sanitary Engineer

ALBANY, N. Y., *June* 6, 1907.

Board of Sewer Commissioners, Seneca Falls, N. Y.:

GENTLEMEN:— I beg to enclose you herewith an order forbidding the use of your sewer system or the discharge of raw sewage into the Seneca river without the construction of a disposal, such as included under the plans heretofore approved by this Department.

I am advised by one of the engineers of the Department that work on this sewer system is practically completed, and that no efforts have been made to construct a sewage disposal plant. Your attention is called, and has been called in a previous communication under date of May 23d, to the fact that this is in violation of the provisions of the Public Health Law, and that it would not be countenanced by this Department.

Your reply under date of May 28th, gives me no assurance that any attempt will be made to comply with the conditions attached by the Department, and I am, therefore, under the necessity of serving upon you the enclosed order. The Department will exercise every means in its power to see that the law is faithfully complied with, and I would suggest that if it is the desire of the board of sewer commissioners to ask for permission to delay the construction of a sewage disposal plant, that such application be filed with this Department forthwith.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

In the Matter of a Sewer System for the Village of Seneca Falls:

Plans for a sewer system and sewage disposal plant for the village of Seneca Falls, Seneca county, N. Y., having been heretofore and on March 2, 1904, approved by the State Commissioner of Health under the provisions of section 260, chapter 414, Laws of 1897; and it appearing from an examination of said plans that a method of sewage disposal was provided for, such plans having been finally approved on the above date; and it appearing that section 260, chapter 414, Laws of 1897 provides as follows:

"The board of sewer commissioners of a village may establish and maintain a sewer system therein. Before taking any proceedings for the construction of a sewer, the board at the expense of the village, shall cause a map and plan of a permanent sewer system for such village to be made, with specifications of dimensions, connections and outlets or sewage disposal works. It may also include any existing sewer in the village. Such plan and map shall be submitted to the state board (department) of health for its approval, and if approved shall be filed in its office. A copy thereof shall also be filed in the office of the village clerk. The map and plan may be amended with the approval of the state board (department) of health, and if amended shall be filed in the same office as the original."

And it having been made to appear to the Commissioner of Health that the authorities of the said village of Seneca Falls are about to connect, or have connected, the said sewer system so as to discharge sewage therefrom directly into the Seneca river without such sewage passing into or through the sewage disposal plant or without its going through any form of treatment in septic tank or otherwise, in direct violation of the provisions of the law above quoted, no permit therefor having been granted by the said State Commissioner of Health; and it further appearing that the future disposition of the sewage of such village is not in accordance with the plan heretofore submitted to this Department for approval and approved by it; and in view of the fact that it is also in violation of section 75 of the Public Health Law,

It is, therefore, hereby ordered that no discharge of sewage in said village of Seneca Falls, from such sewer system, into any of the waters of this State shall be allowed in any other manner than according to plans previously approved by the State Commissioner of Health, which said plans include a sewage disposal plant consisting of a septic tank and sludge bed.

And the board of sewer commissioners of said village are hereby ordered and directed to allow or permit no discharge or disposal of such sewage of the village into any of the waters of this State other than according to the plans approved by the State Commissioner of Health, which include a sewage disposal plant as above stated. And the use of said sewer system without the use of a sewage disposal plant, or in any other manner than that contained in the approved plans, is hereby restrained and forbidden as being a violation of the provisions of the Public Health Law.

And it is further ordered that any connections heretofore made in violation of the terms of the permit and approval granted by the State Commissioner of Health, and the provisions thereof, be immediately disconnected and discontinued thereafter.

A. H. SEYMOUR,
Acting State Commissioner of Health

ALBANY, N. Y., *June* 6, 1907.

ALBANY, N. Y., *July* 10, 1907.

Board of Sewer Commissioners, Seneca Falls, N. Y.:

GENTLEMEN:— On June 6, 1907, I wrote you with reference to your sewer system, inclosing an order forbidding the discharge of raw sewage into the Seneca river without the construction of a disposal plant in accordance with the plans approved by this Department. I have never received any acknowledgment from your board of this order or any communication with reference to it.

I will be pleased to have you advise me as to what action is contemplated by your board with reference to this matter and whether the outfall sewer has been completed. As indicated in my letter of June 6th, the Department will, if necessary, take legal action to see that the order is complied with. I cannot understand why your board should have entirely neglected a matter of this kind.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

SENECA FALLS, N. Y., *July* 13, 1907.

Dr. EUGENE H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Your letter of July 10th to the Board of Sewer Commissioners was delivered to the undersigned, a member of the Board, and I beg to advise you that we are endeavoring to arrange matters to the satisfaction of the State Department, but have not yet the thing in such definite shape as to advise you fully. It has not been the intention of the local board to neglect your Commission, and you will be advised at the earliest opportunity of our progress in the matter.

I am writing this to you personally, without conference with the other members of the Board, because I am just on the point of leaving town for a day or two, and I think your letter should have some recognition.

I beg to remain, very truly,

CLARENCE A. MACDONALD

SENECA FALLS, N. Y., *July* 30, 1907.

Hon. EUGENE H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— The municipal board of the village of Seneca Falls beg to advise you that they have for some time been negotiating with the Lehigh Valley Railroad Company, relative to the acquiring certain lands controlled by them for the proposed sewage disposal plant; that progress has been made, but the deal is not yet consummated, owing to the usual delay of the railroad company.

Our sewer system is not yet completed, connections have not been made, and no permits for connections will be issued without the consent of the State Board of Health, or until the disposal plant will have been completed.

I communicate this for your information at the request of the municipal board.

Very respectfully,

J. M. GUION,

Deputy Clerk

SENECA FALLS, N. Y., *November* 29, 1907.

E. H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I desire to call the attention of your Department to the fact that while you have insisted upon the construction of a disposal plant for the sewer system of Seneca Falls, no such plants exist in the city of Geneva or at the Willard State Hospital, both of which communities empty their sewage into Seneca lake, which is a feeder for Seneca river and the Cayuga and Seneca canal, which flows through the villages of Waterloo and Seneca Falls and must consequently carry along the sewage that is emptied into Seneca lake, or at least a good portion of it. On the other hand, the outlet of the Seneca Falls system is away below the village proper and no village or community can be affected by it, as the nearest one is Baldwinsville, miles east of us, and the water will naturally be purified long before it reaches that point. Kindly look into this.

Very truly yours,
W. B. HARPER,

ALBANY, N. Y., *December* 12, 1907.

Hon. WILLIAM B. HARPER, *Seneca Falls, N. Y.:*

DEAR SIR:— Replying further to your letter of November 29th, in regard to the construction of the sewage disposal plant of Seneca Falls, and the policy which this Department has and is endeavoring to carry out in the requirements for sewage purification with respect to municipalities situated along the Oswego river and its tributaries, I beg to say:

The question of protecting the streams of this State from pollution is, as you know, one of the most important duties of this Department. This pollution is caused in the majority of cases by the discharge of domestic sewage from municipalities located along these waterways. Since the commencement of the term of office of the present Commissioner of Health it has been one of his principal duties to enforce the provisions of the Health Law in regard to the construction of sewage disposal plants with all municipalities where the conditions of pollution of the streams are such as to make it necessary, and where the provisions of the Public Health Law permit him to.

In the particular case of Seneca Falls I find that plans for a proposed system of sewers for the village were first submitted to the Department for approval on September 5, 1902. The plans comprise a collecting system designed upon the separate plan and include a sewage disposal plant consisting of a septic tank and sludge bed. No contact beds or sand filters or any other supplementary treatment for the complete purification of sewage were, however, included in these plans.

After having returned these plans a number of times for corrections and modifications they were revised by the designing engineers and resubmitted to the Department and finally approved on March 2, 1904. Since that date the work of construction has progressed in accordance with these approved plans.

As will be seen from the dates above given, these plans were approved by the former Health Commissioner, Dr. Daniel Lewis During 1907, however, orders were issued by me to the Board of Sewer Commissioners of Seneca Falls restraining them from using the system of sewers then completed without the construction of sewage disposal works as originally provided for and as approved by the Department. It should be noted also that no demand was made at the time of approval, nor has been required since for complete purification, but merely for preliminary treatment by means of a septic tank.

In regard to the places mentioned in your letter, where sewage purification has not been required by the Department, I would say first, in reference to the Willard State Hospital, that this institution has some 2,300 inmates and that no provision for sewage purification has yet been made. This institution is one of the many other communities which will receive the attention of this Department in the future, in accordance with the general notice issued during the present year to municipalities on the

Oswego watershed, requiring sewage purification. The investigations leading up to the action taken by this Department will be referred to later.

In regard to Geneva, the records of the Department show that plans for a sewer system for this city were submitted in 1893, but were returned without approval on the ground that no provisions were included for a proper disposal of the sewage. The plans were subsequently corrected in this respect and were resubmitted and were finally approved in March, 1894. The method of sewage disposal thus approved was by dilution through an outfall extending into deep water in the lake. The reasons for the approval of this method are fully and interestingly set forth in the Fifteenth Annual Report of the Department, pages 45 to 71, inclusive.

Although these communities were the only ones referred to in your letter of November 29th, there are, however, other municipalities situated along the Seneca river and the lakes which have received considerable attention from this Department in the matter of sewage treatment. The village of Waterloo, for instance, though contributing some sewage into the Seneca river, is now preparing plans for a modern system of sewage and under the direction of this Department is including in the same means for sewage purification. The village of Penn Yan, located on the Keuka outlet, is provided with a complete disposal plant, comprising a septic tank, and contact beds for a complete purification. The plans for the village were approved by the Department on June 11, 1903, and the construction of the disposal plant was completed in full accordance with the approved plans. In fact this plant may be considered an admirable example of what should be followed by other municipalities in that section of the State.

The villages of Watkins and Montour Falls, situated at the head of Seneca lake, are not provided with sewage disposal. These will, however, also be considered in carrying out the future policy of the Department in regard to the pollution of the Oswego river watershed.

As you may know, during the present year a very comprehensive investigation was made by this Department of the pollution of the

Oswego river and its tributaries, with a view to determining to what extent these waters were polluted by domestic and industrial sewage, and to enable the Department to determine the best policy to inaugurate in the matter of protecting the streams of this watershed in the future. Based upon this investigation and report, a circular letter was prepared and sent to all municipalities, setting forth the results of the investigation and outlining the policy of the Department in protecting these lakes and streams. This letter you may have seen, but in case you have not, it can no doubt be easily procured from the mayor of Seneca Falls, to whom a copy was sent.

I think it will be evident to you, then, from the foregoing, that the Department has not only been generally active in the matter of protecting the purity of the waters in that section of the State, but that it is succeeding gradually and so far as it can be done under the Public Health Law in securing the introduction of purification before sewage is discharged into the stream. I think it will also be evident to you that the requirement of sewage disposal from Seneca Falls is clearly in line with the policy of the Department, as set forth in the circular letter above referred to, and that no hardship has been put upon this village, inasmuch as partial purification by septic treatment only has been thus far required.

The act of 1903, as you probably know, gives the State Commissioner of Health discretionary powers in regard to sewage disposal only in certain cases. It doesn't give such power in cases where the sewage was being discharged into a system prior to the passage of the act. This is the main reason why the Commissioner can not act in some cases, such as Geneva, but can act in other cases. I can assure you, however, that I am using the power conferred by the 1903 act where it is possible and consistent with local requirements for protecting public health and comfort of any locality.

It frequently happens that a start in the requirements for sewage purification must be made with some one municipality on a stream or river, and that the first demands in such cases are frequently misconstrued as acts of discrimination. In the case of Seneca Falls, however, it must be evident that no discrimination has been or is being made, but merely a demand that the village follow out the original plans which provide for partial sewage disposal by means of septic tanks. It is, in fact, my intention, to have the policy of the Department, as expressed in the circular letter above referred to, followed out with all municipalities upon the Oswego watershed as rapidly and consistently as local requirements demand and the Public Health Law permits, and I hope that you will not only appreciate the desirability and necessity for this action, but will assist the Department where you can in the fulfillment of this important duty.

I hope the above letter, therefore, fully answers the questions raised in your letter of recent date, and I should be pleased to answer any further questions which you may have to ask in the future.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

SHARON SPRINGS

ALBANY, N. Y., *October* 28, 1907.

THEODORE HORTON, *Chief Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR:— In accordance with your directions, on October 23d, I visited the village of Sharon Springs, Schoharie county, for the purpose of investigating complaints made by residents of the village which were received by this Department during the present season respecting defective sewers which exist in the village, and, further, respecting the pollution of Brimstone creek by the sewage from the village which is complained of by riparian owners below the village.

Sharon springs is situated in the northwestern part of Schoharie county about one mile north of the divide between the Mohawk river and Schoharie creek watersheds, and on the Cobleskill and Cherry Valley branch of the D. & H. R. R. The village is incorporated and has a permanent population of 700 and a summer population of about 3,000. As a summer resort the village is noted. Many hundred people visit the place during the summer to take the baths, sulphur and magnesia springs occuring within the village limits. There are fourteen summer hotels in the village.

Brimstone creek rises in the village and is fed principally by the springs, there being very little drainage area above the village tributary to this stream. From the village of Sharon Springs, Brimstone creek flows northerly to Canajoharie creek which in turn flows northerly to the Mohawk river at Canajoharie. The distance from Sharon Springs to Canajoharie, along the stream, is thirteen miles.

Plans for a sewer system and sewage disposal plant for the village of Sharon Springs were approved by the State Board on July 12, 1897. Subsequently the plans were amended by changing the location of the disposal plant.

The system as well as the disposal plant were soon after constructed in accordance with the plans. Since the date of the original construction and within the past six or seven years, sewers have been constructed on Main street or Turnpike road from the railroad station to Prospect street, and in the gully west of Main street at the rear of the Mansion and Union Houses.

A portion of the Main street sewer, extending about 300 feet west of Prospect street, was shown in the original plan, but no plans were ever approved by this Department for the sewer as constructed in the gully west of Main street.

Each of the two sewers above described has been the cause of considerable annoyance since constructed. Stoppages are of frequent occurrence and at such times the sewage is discharged onto the ground surface, creating very insanitary conditions. These sewers are shallow and are thought to have been laid at certain points without cement joints. I did not, of course, by the use of instruments or by means of gauging the flow or testing the sewers in question by use of aniline or other color, undertake to determine just wherein the sewers are defective, since such a test may involve some considerable time and should properly be made by an engineer employed by the village, but a careful canvass of the situation points to one or more of the following probable causes of the stoppages and breaks in the two sewers named:

1. The shallowness of the sewers, which probably results in freezing in extremely cold weather.
2. Insufficient grade, allowing deposit of the sewage and thus causing stoppages.
3. Defective joints, which may cause stoppages by the resulting deposit of sewage, or, by admitting ground water to the sewer in large amounts, the sewer may become overtaxed and in this manner be broken.
4. Insufficient size, especially in the case of the last named sewer, since the sewage contribution has increased considerably since this sewer was designed, and further, by reason of the ground water conditions, a certain inevitable amount of ground water in filtration must be cared for by the sewer and this may not have been provided for in the design.

It is very evident that effective measures should be taken to place these sewers in permanent serviceable condition. The repair or reconstruction of any portion of these sewers should be undertaken only after careful investigation and study by a competent engineer employed by the village. Any other course which might be taken by the village authorities would be false economy as has been proven by the numerous ineffective repairs to these sewers which have been made in the past.

With respect to any special insanitary effects which may be caused by the defective sewers, it was learned that an unusual hydrographic feature exists in the village, which presents a situation demanding immediate abatement of the nuisance. A stream which rises in a swamp to the south of the village crosses the street leading up to the station and disappears in a sink hole or crevice in the rocks near the Turnpike road. A half mile to the north, in the direction of the geological dip, an underground stream appears, and near this stream a spring, owned by Mr. Theodore V. Smith, rises and is piped to supply the Mansion, Howland and Union Houses, and the residences of Theodore V. Smith, Eugene Smith and several others.

The other residences and hotels in the village are supplied by a public water system excepting that one or two hotels are supplied from private springs.

During the past summer, eleven cases of typhoid fever have developed among the residents of the village or among the summer boarders either just before or soon after leaving the village. No cases have developed in houses using the public water supply, and no cases have developed since August in any part of the village or among summer boarders who have left the village.

With respect to three hotels using water from the Smith spring, two cases have developed among guests after leaving the Mansion House, one case developed before and three cases after leaving the Union Hotel, one being fatal, while no known cases have developed among guests of the Howland House. The capacity of the Union House is 200 guests, of the Howland House is 50 guests, and of the Mansion House is 80 guests.

In the private residences supplied by the Smith spring, one case has developed in the family of Theodore V. Smith and two cases in the family of Eugene Smith. In another case the water was from a private, unpolluted spring, and still another case was clearly imported.

The milk supply for the village comes from the farms of Mr. Geo. E. Staley, Mr. J. A. Fonda, Mr. Peck and one other dealer, all of the farms being located north of the village and two of them, the Staley and Fonda farms, bordering Brimstone creek. Mr. Fonda supplies the Smith families and the Union House and about one-third of the rest of the village. Mr. Staley supplies the Mansion House.

As above noted, the stream which crosses the street leading up to the railroad station and which disappears in a sink hole, appears to flow in a direction which would lead near the Smith spring. Although no typhoid cases have occurred in the three or four houses near the station which are connected with the sewer, and very little danger of contamination exists on the upper watershed of this stream, the station is connected and since on many occasions, the Main street sewer has broken open and discharged into the street gutter draining directly into the stream in question, a very possible source of infection of the Smith spring water is therefore presented.

It will be seen, therefore, that circumstances point to the water supply derived from the Smith spring, as the probable source of the typhoid rather than the milk supply.

The duty of the village authorities to permanently and effectually repair or rebuild this sewer is imperative.

There are several insanitary conditions existing in the village, such as the presence of stable drainage in the gutters on Smith street and the inefficient collections of wastes from the hotels, but these are matters which should be investigated and remedied by the local board of health.

Another matter which the village authorities should at once take up is that of the proper disposal of sewage from the village. When the matter of *insufficient sewerage* in the village was brought before this Department some ten years ago, an investigation was made and the village residents were prompt to take action which was recommended, with the result that soon after both water supply and sewer systems were installed.

The sewage disposal plant installed at that time was a crude affair consisting of a screening chamber with about one-half inch mesh screens. These screens are now out of use. The plans for sewage disposal were approved at that time by the State Board of Health with the understanding as expressed in the designing engineers' report that " should at any future time increase in population require additional treatment of sewage, it is the intention of the sewer commissioners to provide for the same by the Waring or other similar process of bacterial filtration or forced aeration of sewage."

From a consideration of the questions affecting the pollution of the stream caused by sewage discharge from the village it is evident that the time has arrived when purification of the sewage of the village should be accomplished before its final discharge into the stream.

In company with Health Officer L. O. White, I inspected the stream at the point of discharge of the sewage and for a half mile or more down stream. The flow from the main outfall sewer showed a rather dilute sewage at the time of inspection, owing doubtless to the fact that much ground water is admitted to the system through defective sewers or from the bath houses.

Further, the population of the village has now nearly fallen off to the normal winter population so that the sewage contribution is not much over 25 per cent. of the contribution during the summer months.

The flow in the stream was said to be but slightly greater than the normal summer flow. A rough gauging of the stream gave a flow of about three cubic feet per second. As would be expected from this rate of flow and from the comparatively small sewage contribution at the present time, it did not appear that a sanitary nuisance was created in the stream at the time of the inspection, although evidence of sewage discharge was observed for some distance below the outfall sewer.

During the summer season, however, with four times the present sewage contribution, a nuisance must inevitably result from the discharge of the raw sewage from the village into the stream: since the dilution would be at such time less than ten times the amount of sewage contributed. The gross pollution of the stream during the summer season is admitted by the village authorities and was testified to by riparian owners along the stream who were interviewed. The owner of one of the farms bordering the stream stated that his cattle refused refused to drink the water in the stream in the summer season whenever his barnyard supply was not low and on being driven to the barn would immediately drink from the latter supply.

The report of Dr. R. C. Reed, a veterinarian in the employ of the State Department of Agriculture, who, during the present season and when the summer population was much greater than at present, investigated the conditions of the stream on behalf of the State Department of Agriculture, states that he "can vouch for the truth of the statement that the stench from the stream makes driving in its vicinity very unpleasant. The water is so bad that cattle should not be allowed to go through the stream, much less, to drink the water."

In view of the foregoing, I should recommend:

1. That the board of health of the village of Sharon Springs be advised to proceed under the provisions and by the authority of section 21 of the Public Health Law in the matter of the repair or reconstruction of the defective sewers in the Turnpike road, connecting with the D. & H. R. R. station; and in the

gully west of Main street at the rear of the Mansion and Union houses in said village.

It should be understood that under the provisions of the Public Health Law when final plans for such alteration or reconstruction of said sewers shall have been worked out and drafted by a competent engineer, they should be submitted for approval to this Department by the sewer and water board of Sharon Springs.

2. That the sewer and water board of the village of Sharon Springs be requested to provide at once means for purifying the sewage of the village before its discharge into Brimstone creek, in accordance with the original intention of the sewer commission, as set forth in the report of the designing engineer accompanying the original application.

The officers of the village are as follows:

Trustees:

Wm. Morrell, *President.*
T. H. Sampson,
L. D. Mereness.

Board of Health:

Wm. Harper, *President.*
Jarvis Swift, *Secretary.*
Dr. L. O. White, *Health Officer.*

Sewer and Water Board:

J. S. Hyney,
C. M. Mallett.

Respectfully submitted,
H. B. CLEVELAND,
Principal Assistant Engineer

ALBANY, N. Y., *November* 14, 1907.

Mr. WILLIAM HARPER, *President Board of Health, Sharon Springs, N. Y.:*

DEAR SIR:— I am enclosing herewith a copy of the report of Assistant Engineer H. B. Cleveland on his recent inspection of certain defective sewers in the village of Sharon Springs.

I beg to state that I have adopted the recommendation tained therein and would therefore suggest that your proceed under the authority of section 21 of the Public] Law in the matter of abating the nuisances arising from t fective sewers described in the above-mentioned report, exist in your village.

Regarding the pollution of Brimstone creek by sewag Sharon Springs, which is also discussed in that report, I inform you that I am this day communicating with the sew water board of Sharon Springs for the purpose of bringing the purification of the sewage of the village before its dis into Brimstone creek. You will kindly inform me at a date of any action which your board of health may take matter of defective sewers first herein referred to.

Very respectfully,
EUGENE H. PORTER,
Commissioner of He

ALBANY, N. Y., *November* 14, 1

MR. C. M. MALLETT, *Sewer and Water Commissioner,*
Springs, N. Y.:

DEAR SIR:— I am writing to you as the representative sewer and water board of the village of Sharon Springs gard to the present disposition of sewage from the vill discharge without purification into Brimstone creek.

Enclosed herewith is a copy of a report made by Mr. Cleveland, assistant engineer in this Department, on a investigation of the pollution of this stream made at the an inspection of certain defective sewers existing in the

This report reviews the matter at length and I beg to st I concur in the conclusions and recommendations co therein.

I would, therefore, request you to at once proceed to hav prepared for the treatment of the sewage of Sharon Spri order that a purification plant designed in accordance with approved methods may be installed and put in operation before the commencement of the summer season of 1908 in your village, so as to avoid a repetition of the nuisance which has been created in the stream during past seasons.

The selection of the type of such disposal plant and the preparation of plans for its construction should be entrusted to a competent engineer, and the plans when completed should be submitted to this Department for approval.

You will kindly inform me immediately when any steps are taken in this matter.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

GLOVERSVILLE, N. Y., *December* 19, 1907.

EUGENE H. PORTER, *Albany, N. Y.:*

DEAR SIR:— The officials of the village of Sharon Springs request me to write to you, stating that they have retained me to make surveys and plans for necessary changes in their sewer system and sewage purification plant as recommended by you. I am having the surveys made for the work, and will prepare plans as soon as they are completed, and submit to you for your approval.

Respectfully yours,
MORRELL VROOMAN

TUCKAHOE

YONKERS, N. Y., *August* 9, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

MY DEAR DOCTOR:— The inclosed petition was left at this office by Mr. Waller, a resident of Yonkers, complaining of and protesting against the condition of the new sewage system of

Tuckahoe which appears to be a nuisance to the people of that part of Yonkers bordering on the said village.

Personally I have investigated the matter and can verify the statement of the petitioners but as the plant is not in our city I do not see what we can do other than refer it to your Department.

I have spoken to Dr. Austin, the health officer of Tuckahoe, and while he is willing to do whatever he can in the matter he feels it is not in his jurisdiction as a permit for the plant was obtained from the State Department.

Will you kindly give this your attention and advise me as to any course it may seem proper to pursue?

Very sincerely yours,
PHILIP S. McCORMICK

YONKERS, N. Y., *July* 24, 1907.

To the Mayor and Board of Health of the City of Yonkers:

The undersigned residents of Yonkers protest against the continuance of the plans and workings of the new sewerage disposal plant of the village of Tuckahoe, said plant being located on the Yonkers road on the boundary line of said village and city of Yonkers, on account of the stench which arises out of its use, and further on account of the negligence of said village officers in building and operating the plant, and further on the ground that it is a menace to health — the smell at times making it impossible to stay out of doors.

ROBERT K. WALKER,
101 Webster avenue,
A. C. AYER,
H. W. MORGAN,
JOS. F. KELLER,
WM. HERZ,
JOHN J. LYONS,
B. RITTER,
F. PRINZING,
M. P. WEIL,

CHAS. LANG,
L. R. COLSON,
107 Webster avenue,
MRS. L. R. COLSON,
ANNA SHAW,
A. P. CORCORAN,
—— SCHWAB,
M. A. AUGER,
93 Webster avenue,
H. Q. BROWN,

Mrs. H. R. BROWN,
GEO. H. IFFLA,
L. A. TANZER,
115 Webster avenue,
GEO. F. PARMELEE,
CHAS. B. WASHBURN,
RUD. LESCH,
DAVID LAMB,
WARREN WRIGHT,
R. WEBBE, JR.,
G. R. LUDLOW.

ALBANY, N. Y., *August* 10, 1907.

President of the Board of Trustees, Tuckahoe, N. Y.:

DEAR SIR:— This Department is in receipt of a complaint from certain residents of your village on account of odors said to arise from the present methods of working of your sewage disposal plant, and I am also advised in other ways that the plant constitutes a public nuisance.

Will you kindly advise me at once of the conditions involved in the present method of disposal? I wish to call your attention to the fourth paragraph of the conditions under which the permit was issued, viz., that the permit shall be revocable at any time when the operation of the disposal plant is unsatisfactory.

I suggest that Mr. Rogers and Mr. Watson, who seem to have been the engineers responsible for the plant, be asked to make a joint report on its present condition.

Respectfully yours,

EUGENE H. PORTER,
Commissioner of Health

TUCKAHOE, N. Y., *September* 6, 1907.

Mr. WILLIAM RUBLY, *President of the Village of Tuckahoe, N. Y.:*

DEAR SIR:— I have before me your note and the letter from the State Commissioner of Health, Dr. Porter, and would have reported on the same had I been in town.

As to the matter of the disposal plant of the village, I will report as follows, and submit the same to Mr. Watson, my associate, for his report, as Dr. Porter suggests:

Not having the complaint as submitted to Commissioner Porter before me I cannot answer it.

The plant being built on approved lines, and not experimental, there is no reason to believe that favorable results will not follow.

The necessity of immediate connections in certain sections of the village gave but a small amount of sewage for the tanks, with the natural result of gas accumulation. At the time of the complaint being made the plant was in operation but four weeks, and had not at that time been accepted as completed, and the appointment of a man to care for the cleaning had not been made. In fact, no opportunity was given the resolving tanks to become perfected in their action.

Complete septic action has not taken place to this date. Still the effluent is improving day by day, with every indication, by appearance and test, of still continuing.

Mr. Charles L. Walker, Inspecting Engineer, New York Sta Department of Health, spent some time with me inspecting th plant and concluded that we were obtaining good results for th period of operation.

GEO. H. ROGERS,
Village Engineer

New York City, *September* 6, 1907.

Geo. H. Rogers, Esq., *Village Engineer, Tuckahoe, N. Y.:*

Dear Sir:— Your letter of to-day duly received wherein you ask me for a report upon the condition of the Tuckahoe sewerage works as I found them on Sunday the eleventh inst. This I shall be pleased to do.

Receiving your information that there had been some complaints with reference to smells, I was particularly careful in my search. Approaching the works from the north and west I failed to locate any trace of sewerage smells.

I found the effluent in a half-digested state and the process working all right. Nothing different from what is the usual condition, in case of new sewerage works starting, for some sixty days. I found more sewerage smells from the Bronx river than the works.

Referring to the tanks, I believe each resolving tank has a capacity of 26,000 gallons, and should be capable of digesting far more than you have connected at present, based on a population of 284 persons at 100 gallons per head, equals about 1,150 gallons per hour, one tank is more than enough, as I know it. Using more might mean secondary reactions. The sewage is a strong sewage for a domestic sewage, possibly this is because the quantity is less than 100 gallons per head — in favor of the tank.

I find you had placed both filtration areas in use. I should have preferred keeping the effluent off the beds until it had become fully digested, as a preventative to sewerage sickness and formation of nodules. Alternating the beds every two days for the aeration and formation of aereobic bacteria to make the most of your limited area.

Making a few suggestions with reference to sweeping tank governor and carrier, cleaning any lodgment in inlet house, was about all that I could see to suggest of a practical nature.

My experiences were that there was little to complain against, and your works were satisfactory.

Yours faithfully,

WM. WATSON,

Engineer and Chemist

ALBANY, N. Y., *October* 8, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— In relation to the alleged nuisance said to be caused by the operation of the village sewage disposal plant at Tuckahoe, I beg to report that, at your suggestion, I inspected the plant on September 27th for the purposes of determining the extent of the nuisance and the especial cause for the odors complained of in the petition of the residents of the city of Yonkers recently submitted to you.

At the time of the visit it could not be said that the odors from the plant were such as to constitute a positive nuisance to the surrounding residents, especially since the nearest house is about 800 feet distant from the plant.

The time available for the inspection did not permit a complete investigation of the conditions, but it is thought advisable that the matter be held in abeyance for a time for the following reasons:

As noted in a recent report of the designing engineers on file in this Department, the plant is hardly in full operation, but is daily approaching a normal condition, both as respecting sewage contribution (essential to a certain extent to its proper action) and respecting the establishment of septic action in the tanks. Further, it was stated that the effluent from the septic tanks was turned onto the filters when the tanks were first put in operation and before the effluent was in a septic condition. This discharge of partially-treated sewage onto the beds undoubtedly gave rise to odors to an extent which would not occur under normal conditions with a septicized effluent.

It is stated by the village officials that no complaints of odors from the plant have recently been received.

I would, therefore, recommend that the matter of the complaint be held in abeyance pending the receipt of further complaints, and that if such complaints are received by this Department, after the plant shall have been in operation for a reasonable time under the conditions for which it was designed to operate eventually, a further investigation be made of all conditions relating to the alleged nuisance.

Respectfully submitted,
H. B. CLEVELAND,
Assistant Engineer

WATERTOWN

WATERTOWN, N. Y., *June* 3, 1907.

MR. EUGENE H. PORTER, *Commissioner State Department of Health, Albany, N. Y.:*

DEAR SIR:— I have been directed by the board of public works, who have charge of the sewer system of this city, to prepare plans for a few extensions to our present system.

It being necessary to procure permits from your Department, it is very desirable to make some inquiries, and get some advice along certain lines before submitting any plans for your approval.

You have on file in your office a map showing our present system, which you will note is in general a combined system. Knowing that your Department is considering the subject of sewage disposal throughout the State in general, the writer would like to know as to whether you have made a study of the conditions that exist along the Black River valley, so as to be able to state definitely, that in your judgment, the time will come when the cities and villages along this valley will be required to ultimately provide for some kind of a disposal? If you have given this subject some consideration, and are of the opinion that Watertown will be required to provide for the ultimate disposal, will you require that any additions at the present time to the existing sewer system to be along the line of disposal.

Referring to one of the streets on which I have been asked to prepare plans, is Clinton street. This street is the second street southerly of Public Square, and extends from Washington street westerly to Massey. The section of the street between Washington and Sherman streets now has an old stone sewer or drain, loosely constructed, and is about twelve inches square; it empties into another stone sewer of the same type, a very little larger, and about one-third of the distance from Washington to Clinton streets. This stone sewer or drain extends northerly from Mullin street across private property, and connects with a stone sewer on Stone street, which also connects with a brick sewer on Washington street. This has an outlet to Washington street, Public Square and Mill street into the river. The other section of Clinton street is already provided with a sanitary sewer which flows westerly to Holcomb street, but the section between Washington and Sherman streets cannot, however, be taken into that section without it is rebuilt and lowered.

In the construction of a pavement on Clinton street, it is proposed to replace the present stone sewer on the street with a tile sewer, using the present stone sewer or drain above referred to, between Mullin and Stone streets, as the outlet. In my judgment this does not in the least conform with any plans which would lead to an ultimate disposal and I should like to know whether a permit to build this sewer as is proposed would be granted by your Department.

Any further information which will be of service and assist us in preparing plans for your approval will be appreciated.

In my opinion complete plans should be made providing for an ultimate disposal in the event that the State Department of Health is going to require this to be done.

Yours very truly,
HENRY E. BAKER,
City Engineer

ALBANY, N. Y., *June* 7, 1907.

MR. HENRY E. BAKER, *City Engineer, Watertown, N. Y.:*

DEAR SIR:— I beg to acknowledge the receipt of your letter of June 3, in which you state that you have been directed by the Board of Public Works to prepare plans for future extensions to your sewerage system. Also making inquiries in regard to certain conditions which may be imposed by the State Department of Health along certain lines before the submission of plans to this Department.

In reply to your inquiries in that letter, I beg to say, in regard to the question of sewage disposal, that it is the policy of this Department to do everything in its power to protect the streams of this State in accordance with the requirement and duties of the Public Health Law, and that in the case of the Black River valley and especially the city of Watertown, the conditions are such that the question of sewage purification must be met within the not distant future. The Black River valley is polluted by domestic sewage from a number of sources and it is simply a matter of time when the conditions will demand purification of this sewage. It is, therefore, very essential that in developing plans for future sewage of your city, this question of sewage disposal should be considered.

Two things should be aimed at in regard to sewerage plans. First, Is the complete separation of all sewage from stream water so that on the grounds of economy and freedom from occasional pollution the sewage can be led and the purification plant suitably located below the city, and in such a manner that neither a useless amount of storm water needs to be treated in said plant at a relatively great expense; and that overflowing of sewage during storms and high water shall be avoided. These conditions can only be secured by carefully designing your system so as to collect in the most favorable manner purely the domestic sewage, and to keep it from discharging into sewers that may now or in the future be devoted to the use of storm water only.

In regard to the proposed sewer on Clinton street, it is evident from what has been just stated that it will be undesirable to run this sewer into the existing stone drain which now crosses private property and connects with the stone sewer on Stone street, ultimately connecting with the brick sewer on Washington street. This proposed sewer in Clinton street should receive only domestic sewage and should be discharged into a system that can be now or ultimately arranged to receive only domestic sewage (that is on the separate plan). Again, the stone sewer crossing private property and on Stone street is not a modern sanitary sewer and unless these stone sewers are replaced by modern vitrified pipe or other satisfactory sewers, the sewer on Clinton street should not be connected with it.

I would, therefore, say to you that any plans for a sewer in Clinton street, discharging into the stone sewer leading across private property to Stone street, will in all probability not meet with my approval and I recommend that this sewer be laid with the direction of flow in the opposite direction, that is discharging into a trunk sewer through Cross into Meadow street, which sewer may now or in the future be used exclusively as a separate sewer receiving only sanitary sewage.

If there is any further information or assistance in regard to these matters or the general question of design for adequate and improved sewage and sewage disposal for this city, I will be very pleased to assist you.

Respectfully yours,

EUGENE H. PORTER,

Commissioner of Health

ALBANY, N. Y., *June 29*, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I beg to report that on June 28 I visited Watertown and conferred with the city engineer and members of the city government, including the president of the Board of Public Works, with reference to the proposed sewer on Clinton avenue.

With these gentlemen I inspected the route of the existing stone sewers in the vicinity of Clinton and examined and advised them with respect to possible routes for a new sewer to serve Clinton avenue. It appears that there are three or four routes for a new sewer to replace the existing one on Clinton avenue, all feasible. The selection of the best one, I pointed out, was a matter depending upon relative first cost with due consideration to future extension, number of persons benefited, etc.

I also pointed out in further explanation of your letter to them of June 7th that this Department is interested not so much in the selection of any one of these particular routes but the question of the proper and adequate separation of the sewage in any route that may be selected. The importance of the separation was pointed out by you in your letter above referred to. Since the route of the proposed sewer which seemed to have favor at the end of this conference was on Clinton avenue running in opposite direction from Washington street and Sherman street to the existing stone drain on Clinton between these streets mentioned and thence across private property near the route of the present stone sewer to Stone street, I explained that the route would probably meet with your approval, if the sewer were made a separate or sanitary one and providing the proposed sewer on private property be constructed now or in the future as a separate sewer to keep the sewage separated from storm water — this latter sewer to form a part of a separate system of sewers by a remodeling of the existing combined sewers in the district according to plans which the city engineer is now developing.

I further explained that, since the proposed reconstruction of the sewer on Clinton avenue is for the immediate purpose of allowing street improvements to be made at an early date, it might not be necessary to construct the separate sewer across private property to Stone street now, provided plans were presented showing this sewer, and that steps be taken to secure a right of way across this private property; temporarily the new sewers on Clinton avenue could discharge into the existing stone drain until the new sewer was required.

As the matter was left the city engineer was to prepare estimates of cost for the various routes of sewer, and after a selection of the best route by the board of public works, plans would be completed and presented to the Department for approval.

Very respectfully yours,

THEODORE HORTON,
Chief Engineer

WHITE PLAINS

NEW YORK, *September* 10, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, State of New York, Capitol Building, Albany, N. Y.:*

DEAR DR. PORTER:— I want to call your attention to the condition of the Bronx river. You may have had your attention drawn to it, but unless you have actually seen the condition of the water with your own eyes and tested with you own olfactory bulbs the stench arising from it, you cannot appreciate what a horrible condition it is in, it is a disgrace to Westchester county and to the State of New York.

I only heard yesterday that a girl, who is obliged to work near it, was made sick by its odors.

I am informed that this condition is due to the fact that White Plains pours its sewer into the river, now you know that there is so little water in the Bronx river that no sewerage should be emptied into it, especially as it is such a thickly populated district.

I am informed that there are prospects in a few years to come of a sewer being put through from White Plains from the Bronx valley, which will dispose of sewerage so far as that valley is concerned, but certainly the district cannot wait for this.

If the White Plains district must empty into the Bronx, I think something should be done to deodorize and disinfect, they could have installed a small electrozone plant which should cost but a small amount to maintain and build, such as was used a few years ago to disinfect a small island up the East river where refuse had been deposited for a few years, would certainly deodorize, and to a degree disinfect, and put this river in a very much better condition. I have only suggested this as it has come to my mind, but certainly something should be done to better the condition which herein exists.

Very truly yours,
WILLIAM HARVEY KING

ALBANY, N. Y., *October* 28, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Pursuant to your instructions to examine and report to you upon the conditions of pollution of the Bronx river arising from the discharge therein of the effluent from the White Plains chemical precipitation works, I beg to submit the following:

The insanitary condition of the Bronx river resulting principally from the discharge of the inefficiently purified sewage from the White Plains chemical precipitation works has been made the subject of a number of investigations and reports by the State Department of Health. Among them may be mentioned more especially:

1. An inspection and report by Mr. E. T. King, Inspecting Engineer on Water Supply, in March, 1906, which is published in the Twenty-seventh Annual Report of this Department for 1906.

2. An inspection and report by Theodore Horton, Consulting Engineer, in October, 1906, published in the Twenty-seventh Annual Report of this Department for 1906.

3. An inspection and report by Mr. H. B. Cleveland, Assistant Sanitary Engineer, on September 27, 1907, recorded in a report from him to you dated October 7, 1907.

Copies of these three reports are transmitted herewith in order to place before you in detail the respective observations and conclusions reached by these observers. In general, we may say that the conclusions reached independently by each of these observers were clearly to the effect that, owing to inefficient operation and overcrowding of the White Plains chemical disposal plant, the degree of purification effected was inadequate and unsatisfactory, and the discharge of this inefficiently purified sewage into the Bronx river below the works produced at times, and especially during the summer, unsightly deposits along the bed and shores of the river, caused offensive odors along and in the vicinity of the river below the works, and, in general, created a serious nuisance to the residents of the towns and villages residing along or near the river below the effluent discharged from the White Plains chemical precipitation works, more especially in the villages of Hartsdale and Scarsdale.

In the second examination recently made by the writer on October 15, 1907, an inspection was made of the precipitation works and of the Bronx river above and below the outfall from these works. Above this outfall, the condition of the river, though having the appearance of some sewage contamination, was quite clear and free from odors and objectionable or unsightly deposits. The effluent from the precipitation works, as it was discharged from the outfall to these works, had the appearance of sewage that had received only slight purification. This effluent was very turbid from the suspended matter not removed by the purification works and had the characteristic odor and appearance of almost crude sewage. The appearance of the stream below this outfall, as far as the writer inspected it below Scarsdale, showed the marked effect of the mingling of this sewage with the relatively clear water above the outlet.

Although the conditions grew less marked as the inspection progressed down the stream, below the outlet, the deposit of sewage sludge upon the shores and bed of the stream were heavy and discolored, and the odor from the stream, for the greater portion of the distance inspected, was offensive. The conditions observed, in the opinion of the writer, were such as to clearly constitute a nuisance along the Bronx river in the villages of Hartsdale and Scarsdale.

A description of the plant and its operation, of its overworked conditions and the possible means by which an improvement could be made by modifications in its construction and operation, were all fully given and discussed in the previous report of the writer accompanying herewith dated October 24, 1906, to which reference is respectfully made, and will not be repeated here. Suffice to say that owing to the additional overcrowding of the plant since that date, and the apparent continued omission to improve the construction and operation of the plant as recommended in the above mentioned report have resulted in a still further detriment to the quality of the effluent discharged, and an increase in the pollution and nuisance created below in the Bronx river.

I beg to say finally that the result of my examination on October 15, 1907 confirms the conclusions reached and stated in my previous report of October 24, 1906 with respect to the inadequate purification of the White Plains sewage resulting from lack of proper management and overcrowding of the plant, and that the pollution of the Bronx river resulting from the discharge therein of this inadequately purified sewage causes unsightly and decomposing deposits along the bed and shores of the stream, produces offensive odors and creates a public nuisance to the residents of Hartsdale, Scarsdale and other villages residing along and in the vicinity of the river below these works.

Respectfully yours,

THEODORE HORTON,
Chief Engineer

The report of Inspecting Engineer E. T. King, and the report of Theodore Horton referred to in the foregoing are published in the Twenty-seventh Annual Report of this Department.

ALBANY, N. Y., *October* 7, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— At your request, I inspected on September 27, 1907, the sewage disposal plant at White Plains as well as the

Bronx river below the outfall sewer from the plant in order to determine if the pollution of the river still continued as outlined in reports of former investigations made by representatives of this Department.

I beg to report that the pollution of the Bronx river, occasioned by the discharge of the effluent from the White Plains disposal plant, was still more evident and extensive, at the time of the inspection, than that described by Mr. Theodore Horton, Consulting Engineer of the Department, in reporting on his investigation of October 17, 1906.

For a description of the plant, reference is made to the above report.

The operation of the plant was not such as to produce the best results, as might be expected in a plant of this type, lacking as it does, the proper arrangements for the application of chemicals at a uniform rate and proportioned to the quantity of inflowing sewage.

Further, the plant is evidently of inadequate capacity to properly treat the quantity of sewage which is now and, probably, for several years has been contributed by the village.

It is not necessary to review the definite reasons for the ineffectiveness of the plant nor to make suggestions as to the improvements or changes which might be made to remove the pollution of the stream resulting from the present conditions since the points at issue were thoroughly discussed in the report of Mr. Horton to which reference has been made.

Respectfully submitted,
H. B. CLEVELAND,
Principal Assistant Engineer

ALBANY, N. Y., *November* 12, 1907.

The President, Village of White Plains, N. Y.:

DEAR SIR:— The attention of your village authorities has, during the past two years, been repeatedly called to the insanitary conditions of the Bronx river, and of the inadequately purified effluent from your chemical purification plant; and they have been repeatedly urged to consider and provide means for increasing the efficiency of operation of this plant and of improving the quality of its effluent in order to abate the nuisance.

In December, 1906, your attention was particularly directed to the offensive conditions of the river below your village and, following an investigation of our engineer in the matter, a report was furnished you pointing out to you means by which at reasonable cost the arrangement of your precipitation works and its operation could be greatly improved. A similar investigation has been made by our engineer on October 15, 1907, which clearly indicates that no active steps have been taken by your village to either follow out any of the suggestions referred to above or to in any way improve the quality of effluent discharged from the plant. On the contrary, it was found that an increased amount of sewage has been allowed to flow to and be passed through this plant with a corresponding further detriment to the quality of the effluent discharged into the river.

I wish therefore to again urge this matter upon you for immediate consideration and to point out to you that the conditions in the Bronx river below your disposal plant, as a result of the continued neglect of your village authorities to improve the operation of your disposal plant, continue to be offensive and to create a public nuisance, affecting comfort and menacing health of the residents of the villages along the river below your disposal works. Descriptions of the inefficient operation of the disposal plant; of its overcrowding; of the poor quality of the effluent and the resulting insanitary condition in the river below the works are all set forth in detail in the reports of the engineers of this Department upon their respective investigations during the past two years. These reports are transmitted herewith and your attention is particularly called to the last report of our chief engineer, dated October 28, 1907, in which he summarizes and confirms the findings of previous inspections with regard to the operation of the disposal plant and the condition in the river below.

The urgency of taking immediate active steps to improve the operating efficiency of your disposal plant, and the sanitary conditions of the river, is in no way lessened in view of the approaching construction of the Bronx valley outfall sewer, for it will take years to complete this sewer and put it into operation. In the meantime the offensive conditions in the Bronx river below your village, which are now a public nuisance and a menace to health, will increase in severity and danger.

In view, then, of the serious pollution of the Bronx river and its effect upon public health and comfort of the villages along the river below White Plains, I feel it my duty to again appeal to you, in the hope that a full realization of responsibility of your trustees in the matter, or a feeling of civic pride may result in a definite and speedy action toward the relief of the residents of these villages.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

WHITE PLAINS, N. Y., *November* 27, 1907.

MR. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

MY DEAR SIR:—In reference to your Department's reports and letter concerning the White Plains sewage disposal system, I have been requested by President Brown to inform you that our sewer committee will at once take up matter referred to and use the best endeavors to rectify causes for complaint forthwith. Will let your Department know in a few more days what progress and steps have been taken.

Yours respectfully,

JOHN T. REHILL,

Chairman Sewer Commission

YONKERS

A request was received on November 14, 1907, from representatives of the Tasker-Halsted Realty Company for information as to the submission of plans for sewer construction and as to what requirements would be laid down by the Department in the matter of sewage disposal.

The company was advised as to the details of submitting the plans and urged to submit, through their engineers, a preliminary report giving data pertaining to the location and the surrounding conditions, together with an outline of the method of sewage disposal proposed, before finally preparing plans.

PLANS FOR SEWERAGE AND SEWAGE DISPOSAL FOR STATE INSTITUTIONS

The work performed by the Division in the preparation of plans for State institutions during the past year was mainly in the completion of plans and reports started in 1906. During that year plans and reports were completed for the following institutions:

Kings Park State Hospital, Long Island.
Rome Custodial Asylum.

Although considerable work had been carried on during 1906, in the preparation of plans for other institutions, they were not completed until in the year 1907. The institutions, then, with respect to which detailed plans and reports were completed during 1907, are the following:

Newark Custodial Asylum.
Rush Industrial Institution.
Western House of Refuge at Albion.

HUDSON RIVER STATE HOSPITAL, POUGHKEEPSIE

A preliminary report on sewage disposal for the State Hospital at Poughkeepsie was submitted during the year for the informal approval of the Department. Complete plans were in course of preparation at the close of the year.

NEWARK CUSTODIAL ASYLUM

ALBANY, N. Y., *April* 2, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— I beg to transmit herewith the report of Assistant Engineer H. N. Ogden upon proposed sewage disposal for the Newark Custodial Asylum together with detailed plans for the same.

The report is fully descriptive of the plans and contains an estimate of cost of the proposed work. The report is otherwise full and selfexplanatory.

Respectfully yours,
THEODORE HORTON,
Chief Engineer

ITHACA, N. Y., *March* 25, 1907.

MR. THEODORE HORTON, *Chief Engineer, State Department of*
Health, Albany, N. Y.:

DEAR SIR:— I have the honor to submit to you herewith plans, via United States express, for the proposed sewage disposal plant for the Newark Custodial Asylum together with the following report:

According to information furnished by the superintendent of the asylum, there are at present about 600 inmates, with 100 doctors, nurses, and other assistants, a present resident population of 700 persons. The superintendent estimates that this number may, in the future, be increased to 1,000, and I have assumed the latter population in my computations.

He further estimates the present water consumption at 40,000 gallons per day, of which about 10,000 gallons are used for steam, leaving 30,000 gallons to be turned into the sewers or about 43 gallons per head per day. I have assumed a per capita consumption of 50 gallons or a total future sewage flow of 1,000x50 or 50,000 gallons per day.

The present disposal method is to collect the sewage from the different buildings into an outfall sewer running along the western slope of the hill on which the Asylum stands, the sewer discharging ultimately into the Erie canal. The sewer is so located that all future buildings may readily be connected as they are built. The location of this sewer is shown approximately on plans marked "N. Y. State Custodial Asylum, Newark, N. Y." No. "72" and "76," on file in the office of the State Architect.

It is proposed to intercept the flow of the sewage as it passes down this outfall, treat the sewage in a septic tank and on filter beds, and discharge the purified effluent back into the same outfall pipe. On account of the steep slopes of the side hill on which the disposal plant will be located, it has been necessary to make the beds long and narrow, and on account of the requirements of the grade of the outfall, to make them comparatively shallow. It is believed, however, that the purification effected will be satisfactory and the plant reasonably permanent.

The tank, 35′x15′x7¼′ contains 29,500 gallons, the full twenty-four hour flow at present and about three-fifths of the future daily flow. In an institution of this kind the daily flow is nearly all discharged during the day so that the rest period in the tank at present will be probably only about fourteen hours and when the estimated extensions have been made the rest period will probably be about eight hours.

The tank, of concrete strengthened with expanded metal, is to be built just north of manhole No. 4, using that manhole as a small grit chamber, from which entrance to the tank is made by two 6-inch cast iron pipes. Two tight manhole covers are provided in the roof, one at each end and two ventilators for the escape of the gases of decomposition are also contemplated. The sewage passes out of the tank over a steel wire edge into the distribution chamber, also provided with a manhole cover and a ventilator. A 12-inch automatic siphon is located in this chamber and discharges the contents automatically in quantities of about 800 gallons at a time. The chamber is large enough to contain three alternating siphons, but since the plant will have capable supervision, it seemed to be best to allow the distribution to be made by hand as the capacity of the beds becomes known.

The accumulation of sludge in the tank, which will probably have to be withdrawn twice a year, is intended to be run into furrows in the hillside below the tank from which the liquids can drain away and the residue be covered, if deemed necessary.

The discharge of the siphon is carried through a 12-inch pipe, laid on the east side of the beds and empties onto each bed through three distributing chambers connecting with wooden carriers laid on the top of the filter material.

The best material for the beds, I was not able to definitely determine. From a brief examination of the ashes from the heating plant it appeared that a sufficient quantity of hard cinder would not be readily obtainable and that it would be cheaper and more economical to haul sand from banks which, I understand, are within reasonable distances. If sand is used, I recommend screening to exclude particles greater than 1 mm. and smaller than .25 mm. diameter, such relatively coarse sand and frequent dosing in small quantities, giving approximately the conditions under which trickling filters have been found to work so admirably.

A by-pass is provided by which the septic tank can be cut out for cleaning.

The 8-inch drain under the beds is given a greater slope than the beds themselves, being placed in a depression for that purpose and is intended to just meet the present outfall sewer at the north end of the beds.

The distributing manholes are square boxes of concrete, with iron covers, the grates being pieces of plank, set in grooves in the concrete walls.

The estimate of cost follows:

80 cu. yds. of concrete at $10 per yard....	$800 00
2,000 sq. ft. of exp. metal, at 7c per sq. ft..	140 00
5,600 lbs. of steel I-beams at 4c per lb....	224 00
Three 6-inch gate valves at $25 each......	75 00
260 ft. of present sewer relaid at 25c per ft.	65 00
100 ft. of 6-inch sludge drain at 30c......	30 00
6-inch inlet complete..................	15 00
45 ft. on 8-inch by-pass at 45c...........	20 00
550 cu. yds. excavation at 30c...........	165 00
Engineering and superintendence........	150 00
Total for septic tank.........................	$1,684 00

12-inch automatic siphon	$100 00	
3,000 cu. yds. excavation at 30c	900 00	
Finishing slopes, raking and seeding, 2,000 sq. yds. at 10c	200 00	
260 ft. of 8-inch drain at 20c	54 00	
260 ft. of 12-inch distributing pipe at 50c.	130 00	
360 lin. ft. of wooden distributors at 10c.	36 00	
12 distributing chambers with M. H. covers at $9	108 00	
750 cu. yds. of filter sand at $1.75 per yd.	1,313 00	
Engineering and superintendence	200 00	
Total for filter beds		$3,041 00
Total for plant complete		$4,725 00

Respectfully submitted,
H. N. OGDEN,
Assistant Sanitary Engineer

ALBANY, N. Y., *April* 2, 1907.

MR. GEORGE L. HEINS, *State Architect, Albany, N. Y.:*

DEAR SIR:— I beg to transmit herewith plans for the proposed sewage disposal plant for the Newark Custodial Asylum. The copy of the report of the assistant engineer, Mr. Ogden, which accompanies these plans, describes in detail the general features of the design and gives an estimate of the cost of construction.

Although the total cost for the plant is shown as $4,725, I would recommend that this be slightly increased to cover possible contingencies and possible increase in labor.

Will you be so kind as to look the plans over and review the report and if there are any suggestions that you wish to make in regard to them I shall be very glad to receive them.

Will you also be so kind as to return the original tracings together with two sets of blue prints to me at your earliest convenience.

Respectfully yours,
EUGENE H. PORTER,
Commissioner of Health

RUSH INDUSTRIAL INSTITUTION

The plans for sewage disposal for the Rush (formerly Rochester) State Industrial Institution were prepared during the latter part of 1906 and the report of Assistant Engineer H. N. Ogden, dated January 7, 1907, under whose supervision the plans were prepared, may be found on page 762 of the Twenty-seventh Annual Report of the Department.

These plans were turned over to the State Architect on January 15, 1907.

WESTERN HOUSE OF REFUGE, ALBION

ALBANY, N. Y., *April* 16, 1907.

Hon. CHARLES E. HUGHES, *Governor of the State of New York,*
Albany, N. Y.:

SIR:— I have your communication of April 15th, inclosing a letter from Mr. Matthew Edgar, of Albion, N. Y., who makes a complaint regarding the sanitary condition of the Western House of Refuge for Women at Albion. The communication is herewith returned to you.

In October, 1906, complaint was made to this Department by the town board of health of the town of Albion with reference to the sewage disposal plant at the Western House of Refuge, in which it was alleged that it was a public nuisance.

Subsequently Miss Jane L. Armstrong, secretary of the Board of Managers of the institution, also referred the complaint to us, calling our attention to the same.

It appears that the sewage disposal plant is so operated as to constitute a public nuisance and that it will require an expenditure of a sum of money on the part of the State to either so operate the plant as to prevent it being a nuisance or else to construct a new disposal works or modify that already existing.

At that time this Department was engaged in preparing plans for sewage disposal plants and doing work of this character for a number of State institutions. I am of the opinion that State institutions should present models in their sanitary arrangements to the localities in which they are located, and in the endeavor to secure better arrangements for the disposal of the sewage of State institutions we have prepared here plans for a number of such.

Section 13-a of the Public Health Law provides that "the plans for all water supply, sewerage, sewage-disposal, and garbage-disposal works, shall be subject to the approval of the state commissioner of health before being adopted or constructed."

Owing to the fact that the State Architect had no sanitary engineer qualified to properly prepare such plans, the work was undertaken by this Department and pursued as long as we were able to do so. As there were other duties of pressing importance before the engineering division, it became impossible for us to proceed any further with the work. I recommended, however, to the State Architect and the State Architect and the State Fiscal Supervisor of Charities at a conference that was held that the sewage disposal plant for the Western House of Refuge be so modified or reconstructed as to abate this nuisance and that arrangements be made for the expenditure of such funds as would be necessary.

It was arranged at this conference that the Health Department would take up and prosecute this work on sewage disposal for State institutions if funds were appropriated for that purpose. This case is one of those it has on the list to give immediate attention. The construction and operation of sewage disposal plants for State institutions should be under the control of expert sanitary engineers and if an appropriation were made for that purpose the Department of Health would gladly take up this work.

I am not aware that any appropriation has been granted for the purpose of remodeling this sewage disposal plant and I would recommend that the State Board of Charities have such work done as is necessary to put the premises in a sanitary condition. This Department will be glad to lend such aid as it can in the matter and also the advice of its expert sanitary engineer, and would be glad to assist the officers having charge of this institution in bringing about a better condition.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *May* 1, 1907.

Dr. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— At your request I beg to report upon the question of remodeling and improving the present sewage disposal plant at the Western House of Refuge for Women at Albion, Orleans county, for the purpose of abating the nuisance arising from its operation under present conditions. This report includes a preliminary estimate of cost for the modification of the plant as outlined below.

After careful study of the present plant I would recommend:

1. The conversion of the present strainer chambers into a septic tank.
2. The conversion of the present coke aerating beds into broken stone contact filters.

This plan of modifying the plant involves the following changes and improvements:

1. The rearrangement of partition walls in the present strainer chambers and an increase in the height of some of the outer walls, the location of the outer walls of the structure remaining as at present.
2. The construction of a roof over the septic tank.
3. The addition of inlet and outlet chambers to the septic tank.
4. The furnishing of broken stone for filling the filters.

Together with the addition of the necessary outlet pipes, distributing pipes, valves, manholes and appurtenances for the proper operation of the plant.

Before the work is undertaken detail plans should be prepared after a close survey of the present plant has been made and the arrangements at the institution, with respect to sewerage, have been determined.

An approximate estimate has been made of the cost of remodeling the plant and it is expected that such cost, exclusive of engineering, will amount to from $3,000 to $3,500.

Respectfully submitted,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 16, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— At your request I have made a revised estimate of cost for remodeling and improving the present sewage disposal plant at the Western House of Refuge for Women at Albion, Orleans county, N. Y. This estimate is made on the basis of a partial remodeling of the plant, since it is stated that the funds available will not permit the complete remodeling of the plant at present.

As noted in my report, dated May 1, 1907, I should recommend:

1. The conversion of the present strainer chambers into a septic tank.
2. The conversion of the present coke aerating beds into broken stone contact filters.

The revised plan of modifying the plant involves the following changes and improvements:

1. Cutting arched openings in the cross-walls of the present strainer chambers.
2. The addition of inlet and outlet chambers to the septic tank.
3. The furnishing of broken stone for filling the filters. Together with the necessary outlet pipe, distributing pipes, valves, etc., for the proper operation of the plant.

The revised plan differs in the following particulars from the plan for which estimate of cost was furnished in my report of May 1st:

(a) It is not proposed under revised plans to construct a roof over the remodeled septic tank. This omission prohibits the use of the present forced air draft pipe to the engine house as a ventilating pipe to be connected with the smoke stack at the engine house, and thus leaves no provision for removing and consuming the gases generated by bacterial action in the septic tank. Further, the operation of the septic tank, if unroofed, will not be as satisfactory as if the tank were covered. These facts should be borne in mind and a roof added to the septic tank as soon as finances permit.

(b) The remodeling of the present strainer chambers so as to convert them into a septic tank, consists, under the revised plan, of simply cutting arched openings in the present cross-walls instead of removing the cross-walls; further, the revised plan does not provide for the construction of two additional longitudinal walls, thus forming four compartments as in the former plan. This change, while not permitting as much flexibility of operation, is not expected to materially alter the efficiency of the septic tank.

(c) A reduction in the estimated cost has been effected by planning to install fewer and less expensive valves which are to control the flow through the tank.

(d) It is not proposed under the revised plans to install, at present, the timed siphons which would be necessary for the most efficient operation of the contact beds. However, the siphon chambers should be constructed, as far as possible, with such installation in view, while at present, and until the need for greater efficiency because of larger sewage contribution requires the introduction of timed siphons, ordinary flush-tank siphons may be used.

In the above, and several other respects, the preliminary plan has been revised so as to call for a lower cost of construction, without, however, sacrificing the essential features for successful operation, except as noted above.

The revised approximate estimate of cost amounts to from $1,100 to $1,200.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *May* 29, 1907.

HON. G. L. HEINS, *State Architect, Albany, N. Y.:*

DEAR SIR:— I inclose herewith supplementary report of our Consulting Engineer, covering revised estimate of cost for remodeling and improving the present sewage disposal plant at the Western House of Refuge at Albion, N. Y.

The first estimate, which amounted to $3,500, covered more extensive improvements, such as covering the septic tank, and conversion of coke aerating beds into broken stone contact filters. The new estimate, while not including many features that are essential to convenient and economical operation of the plant, does cover, however, the essentials necessary to give a satisfactory means of purification, and a resulting effluent that will be nonputrescible.

The report explains fully the structural features included in the revised estimate of cost, and if these changes are made, there will result a very much better sanitary condition of the disposal plant than now exists. I should strongly recommend, however, that the complete modifications, as outlined in the first estimate of cost, be carried out just as soon as funds are available.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

PROTECTION OF PUBLIC WATER SUPPLIES

EXAMINATION OF WATER SUPPLIES

BROCKPORT

ALBANY, N. Y., *March* 27, 1907.

OHN LIVERMORE HAZEN, *Brockport, N. Y.:*

AR SIR:— I beg to acknowledge the receipt of your letter of h 12th inquiring with regard to the proposed water supply of village, to be taken from Lake Ontario some nine miles ut from Brockport.

e question of securing a pure water supply from a large ike Lake Ontario is a very broad and important one. It will d primarily upon the amount of pollution along the lake the proposed intake, the distance from the shore of the loca- f the intake, the location of sewage outfalls near the intake he effect of tides and winds in carrying any sewage from outfalls out to the intake.

is evidently quite impracticable to make recommendations ard to a suitable location of intake for your water supply or you with respect to the necessity of preliminary filtration, ut a careful and extended investigation involving the above lerations. Only suggestions can be given in advance of such igations and these I am very glad to offer you.

r instance it appears from the location of villages along the io shore, that there would be little difficulty in securing a supply if a intake was located a considerable distance from hore. In other words, the pollution from the villages is ratively so small and the distance comparatively great, that is little likelihood of sewage in any dangerous amounts ing an intake favorably located at a considerable distance the shore.

regard to the effect of the Rochester sewage, it is rather safe that no sewage from the proposed outfall for the sewage of

Rochester could, even under the most unfavorable direction an intensity of wind action, reach your intake with the location pr posed. In fact float observations made in the recent studies c Rochester sewage disposal indicate that under almost no cond tions of direction or intensity of wind could the sewage from th proposed Rochester outfall reach the intake of the Ontario wate company. It should be said, however, that plans for the Rochester sewage disposal have not been officially submitted to thi Department for examination and it is, of course, impracticabl to express any definite opinion in regard to them until thes plans are received and examined and the general question o sewage disposal carefully studied.

I regret that this Department is not in a position to undertake an investigation that would lead to definite advice in the matter of selection of a pure water supply for your village, but would suggest that you secure the services of a competent engineer to advise you with respect to your new works. I hope, however, that the suggestions above given may be of service to you and that if there are other points about which we can give you further suggestions or advice, you will not hesitate to call upon me.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

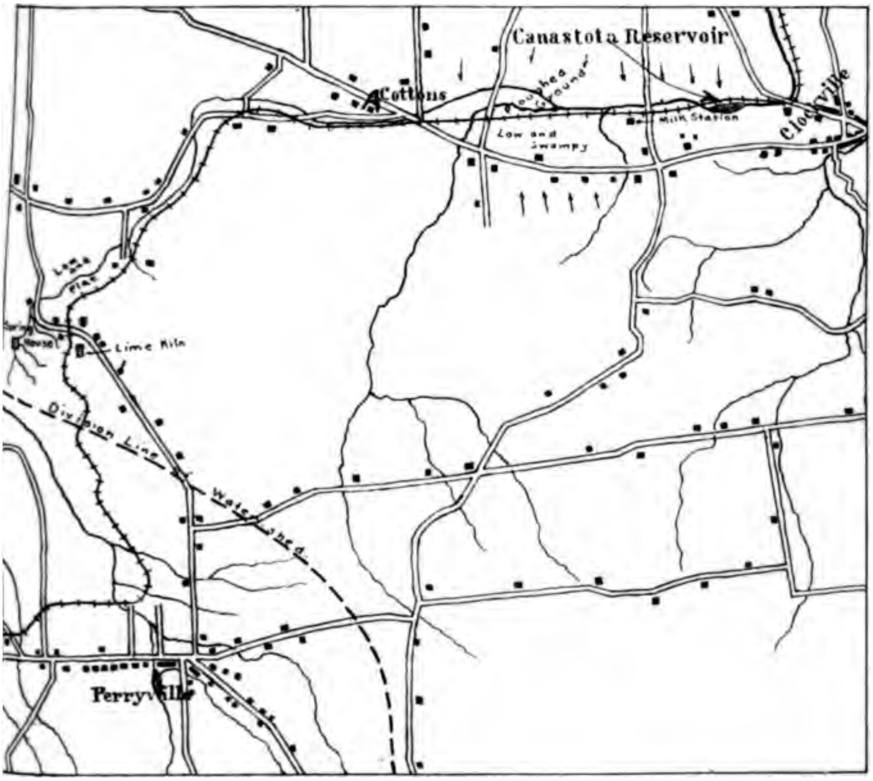
CANASTOTA

ITHACA, N. Y., *October* 8, 1907.

MR. E. H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I have the honor to make the following repor upon the conditions of the Canastota water supply, in accordanc with your request dated September 27th.

I find that in 1905–6, a typhoid epidemic of some severit was experienced in Canastota. This epidemic was investigated b Prof. O. H. Landreth, then Consulting Engineer of the Depar ment, and his report is on file in the office. The health office Dr. Taylor, has reported that during the past year he was calle


Canastota Reservoir
Cottons
Ploughed Ground
Low and Swampy
Milk Station
Cloc ville
Low and Flat
Spring House
Lime Kiln
Division Line Watershed
Perryville

ofessionally to visit a patient ill with typhoid fever, at a house urked A, on map attached, and that, foreseeing the possible ect on the water supply, he instigated such sharp and effective asures, that no fever in Canastota followed. Your request was, it I should examine the watershed and report to you on the sent conditions as tending to produce the epidemic of 1905–6 ain, and on the possibility of improving the same.

The village of Canastota in the town of Lenox, Madison county, s a population of about 3,500, with a very slow rate of growth, .: 10 per cent. between 1890 and 1900 and 7 per cent. in the e years, 1900 to 1905. The present water works system was ilt in 1885, under the engineering direction of Mr. E. D. nalley. The collecting system consists of an (unknown) num- r of feet of six-inch cement pipe, intercepting and collecting e underground water as it comes out of the lime rock about five les southwest of Canastota. The water thus intercepted is rned immediately into an open ditch or creek in which it flows istance of about two miles to the reservoir. From the reservoir flow is by a cast iron pipe directly to the village.

There are two sources of danger to be apprehended, viz.: from houses scattered over the watershed, draining directly or in- ectly into the stream, and from the L. V. R. R., whose tracks through the area. There is also the annoyance and discomfort to the fact that the open ditch or stream in its course flows ugh plowed ground so that the water in the reservoir is usually id from the large amount of clay carried in suspension. The h has one large tributary during the two-miles' flow, and a ber of smaller ones, so that the water which starts as ground er is well mixed with surface water before it reaches the reser- . Nor is this probably altogether an evil, for, although with- any analysis for confirmation, I believe that the ground water the spring house is very hard and that the admixture of ace water reduces this hardness considerably.

he entire question is reducible to three direct problems:

How to remove the domestic pollution which now contami- s the water.

. How to remove the turbidity, which is very persistent, and ch arouses unfavorable comment continually.

3. How to devise improvements for solving one and two, which shall not decrease, but rather increase, the daily volume of water.

The first suggestion naturally made under the circumstances is that the water from the springs be carried through the part of the valley where contamination is most to be feared in a pipe. But, the pipe to be efficient would have to extend the entire distance at a cost of nearly $10,000, and giving a supply which apparently would be inadequate. According to the statement of the present superintendent there have been times when the combined flow of surface and spring water was not enough for the village. Certainly during a portion of the past summer the reservoir level gradually decreased showing the flow to be insufficient without storage. The possibility of removing all contaminating influences from the watershed is remote, as there are some fifteen houses directly on the banks of the main stream draining into the creek, and the L. V. R. R. trains run for a distance of two miles between ditches emptying into the stream so that the possibility of contamination from the railroad train closets is great. The ploughed ground from which the turbidity comes is near the reservoir with no possibility of excluding the drainage therefrom. All possible improvement made on the physical conditions of the watershed cannot deliver a safe water — and therefore, I am convinced that it is not possible to look to water rules for the entire safety of the water.

There are two other streams in the vicinity, the waters of which can be brought to the reservoir (or into the pipe line to the village) so that there is an ample supply in sight even when the present supply becomes too small, and any improvements now inaugurated will be of permanent value.

I recommend, therefore, for the benefit of the water supply of Canastota and for the future immunity from disease of her citizens, that a filter plant, using a coagulant, be designed for use with the present plant. I believe that the present basin should be used for a sedimentation basin, and that a by-pass should be provided whereby water in time of storms may be carried around the reservoir.

In this way the reservoir water would always be kept clear and the rapid clogging of the filter prevented. I believe that the type of filter selected should be the gravity type of rapid filter, using air as a cleaning or washing agent. The plant has an income of less than $4,000 and this is not sufficient for running expenses so that a balance has to be made up by taxation. Under these conditions it seems unfortunate that any large sum should have to be added to the constructive account, the same requiring an additional yearly levy for maintenance.

I believe that a constant menace to the health of the residents of Canastota exists, until the filter plant is installed, and that such installation is the cheapest method of improving present conditions. I recommend that an immediate and detailed inspection of the houses on the watershed be made, and that the rules, said to have been adopted by the State Board of Health some years ago be strictly enforced.

I recommend that the L. V. R. R. be notified that they are required for all trains to keep all toilet or closet doors locked between the stations of Blakeslee and Clockville. I recommend that the immediate possibility of improving the present water by diverting storm water and using sulph. of alumina in the present reservoir be suggested to the water board of Canastota.

Respectfully submitted,

H. N. OGDEN,

Assistant Sanitary Engineer

ALBANY, N. Y., *December* 31, 1907.

Mr. WILLIAM TAYLOR, *Health Officer, Canastota, N. Y.:*

DEAR SIR:— The question of the condition of the water supply of Canastota, and of the health of the residents that have to depend upon this supply for their daily needs, is a matter that has been under serious consideration by me for several months, and I am pleased to say that a report of our Assistant Engineer, Prof. H. N. Ogden, upon his investigation of the sanitary conditions of this watershed, is completed and is being sent to you herewith.

The conditions upon the watershed, as found by Prof. Ogden, are such as to readily explain the continued recurrence of typhoi fever in your village. The report covers the specific and gener information, leading to the conclusion that, if your village is to protected against the present and increasing danger of typhoi fever and other infection of your water supply, some measur must be taken at once to guard the supply.

The means by which this protection of your supply can gained are clearly set forth in Prof. Ogden's report, and the su gestions and recommendations contained therein I concur in. I the matter of the L. V. R. R. the question of requiring the con pany to lock all toilet-room doors on trains passing between Blake lee and Clockville will be at once considered by me, and, if I fin that under the Health Law it is both possible and practicable have instituted and enforced the custom, I will take such steps issue such orders, and will bring it about.

I shall be pleased if you will kindly advise me at an earl date as to what action, if any, has been taken by your board, the village trustees, in carrying out these much needed improv ments to your water supply. I shall also be pleased to give yo any additional information or advice, not contained in the accon panying report, that it is possible for me to give you, if you request it.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

HUDSON

HUDSON, N. Y., *July* 12, 1907.

State Department of Health, Albany, N. Y.:

GENTLEMEN:— At the last regular meeting of the board public works of the city of Hudson, the superintendent of publ works, Mr. Robert J. Harding, was directed to confer with yo Board and report relative to water supply of the city of Hudso The question to be decided is whether or not a division of t filter at the reservoir in the city of Hudson into two units necessary in order to comply with the requirements of your Board.

Will you kindly advise me as to what decision your Board reaches upon that question so that I may be in possession of such information before the August meeting of the board of public works, which will be held on the first day of August. I regret troubling you in this matter, but I feel that the duty I owe to the people of the city of Hudson necessitates the same.

Thanking you for your courtesy and your past favors, I remain,

Very truly yours,
R. MONELL HERZBERG

ALBANY, N. Y., *July* 15, 1907.

Mr. R. M. HERZBERG, 542 *Warren street, Hudson, N. Y.:*

DEAR SIR:— Superintendent of public works, Mr. R. J. Harding, was in the office in conference with our engineer on Friday last.

The representation made by Mr. Harding was to the effect that while the division of the filter into two units as you have suggested, is a desirable addition to the filter plant, the present time is not a fitting one for the construction of such a wall. It appears from his statement that the sand layer in the filter has become very much reduced and that it would be necessary in the near future to provide additional filter material.

From our standpoint, therefore, it would seem wise to defer the construction of the division wall until a time of year when the amount of organic matter in the water and the danger from using unfiltered water is less than in the summer months and to a time when the substitution or addition of new filter material may be made. It would evidently be for the best interests of the city to have both operations done at once and if you can arrange to have this work carried through this fall the Department will consider the interests of the city of Hudson well looked after.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

HUDSON, N. Y., *September* 6, 1907.

DR. EUGENE PORTER, *State Health Commissioner, Albany, N. Y.:*

DEAR SIR:— I am enclosing you a copy of a letter from Mr. Allen Hazen giving the Commission advice relative to the filter of our water system, as a result of an examination made by him.

It is the intention of the Commission of Public Works to follow his directions if suitable and agreeable to you.

Yours very truly,
ROBERT J. HARDING,
Superintendent of Public Works

NEW YORK CITY, *August* 15, 1907.

MR. ROBERT J. HARDING, *Superintendent of Public Works, Hudson, N. Y.:*

DEAR SIR:— Yesterday I spent with you going over your filter and waterworks, and advising you regarding the same, and I am writing this to confirm the most important points upon which I gave you such advice.

The matters that I advised are as follows:

1. *Dividing filter.*— It will not pay to divide the filter into two parts. If the filter was being built new I would by all mean build it in two parts, but in your present condition the expens of dividing it is not warranted.

2. *Gravel and underdrains.*— The underdrainage system an gravel seems presumably to be in good order. That being th case I would not incur any expense in digging this up and recon structing it at this time, but after removing the top and dirties part of the present sand layer I would put on new sand to th required depth.

3. *New sand.*— New sand is required. There is not enoug sand now in the filter and the sand there is not of very goo quality. The sand to be added should be washed and should me standard specifications for size, and should be free from lim The local bank sands probably all contain lime. This you ca easily determine by testing them with hydrochloric acid. San for the Albany filters was obtained from the Hudson river a sho

distance above Hudson. This sand is free from lime and there are deposits from which sand can be obtained which can be washed so as to make perfectly satisfactory filter sand. It would be possible to get Long Island sand of good quality. This also would require washing. The cost of Long Island sand we estimated roughly as follows:

Delivered at dock, per cubic yard	$1 00
Hauled up the hill	75
Washing and placing	25
Total	$2 00
Scow measurement and 10 per cent. loss by washing and and shrinkage	25
Total cost per cubic yard in filter	$2 25

This, of course, is a very rough estimate. I should consider the minimum amount of sand to be replaced at three feet, which would require about 2,500 cubic yards. If you have a chance to get samples of local sand dredged from the river, representing the materials which you could get cheaply, they may be sent to this office and we can tell you whether they would do for stock.

4. *Sand washer.*—A modern sand washer, designed to operate satisfactorily with about forty pounds water pressure, should be installed. We could give you a design for such a washer. The cost of the washer erected probably would not exceed $500.

5. *Aerator.*— Install an aerator at the filters so that the water coming to them can be aerated by some of the surplus head. Apparently this can best be done by tapping the pipe coming to the filters, back of the gate, and making an 8-inch or 10-inch connection thereto, which connection would supply, first, a nozzle discharging to the filters, and second, the sandwasher, each controlled by appropriate gates. The aerator cannot be used in winter, and the old outlet would have to be used to bring the water up to the usual level before the aerator could be started.

6. *Masonry at the inlet.*— Cut away the masonry at the inlet so that the top will not be higher than the lowest sand line, and use

brick or stone to build it up as needed to keep it nearly up to t sand line. The top of the masonry should never be higher th the sand line.

7. *Gravel about inlet.*— Dig up all the gravel to the bottc about the inlet and place fine gravel over the coarse gravel, on slope so that the sand will not have an opportunity to subsequent work into the coarse gravel or stones, and then refill the spa about the inlet with sand. The sand should rest on the floor f two feet about the inlet, and may then come up to such slope the gravel will stand.

8. *Pipe from water above sand to gate chamber.*— There i pipe from the water in the filter above the sand to the gate cha ber. Take off the gate on this pipe and put on a flange or c There should be no use for this gate.

9. *Weir.*— Cut out the masonry dividing wall between the t chambers in the gate house, removing the castiron frame, or a p of it, if necessary, and set a permanent standard weir in ceme so that the crest of the weir will be between five and five a a half feet below the ordinary level of the water upon the filte

10. *Rate of flow gauge.*— Set a 6-inch pipe, with open end the water, in the upper chamber, and put in it a float carryin marker to show the rate of discharge on a suitable scale. Cal lations can be made and the scale graduated to show millions gallons per day. It will then be possible to regulate the cont gate to give any desired rate of discharge, and to modify the sa and the results will be at once indicated without waiting to whether the reservoirs rise or fall with the changed conditions.

11. *Loss of head gauge.*— Install two other 6-inch pipes, w caps to make the bottoms water-tight, and with ¾-inch connecti to (1) the flange on the pipe coming through the wall, indicati the level of the water above the sand; and (2) from the m effluent pipe back of the control gate, indicating the level water in the underdrains of the filter. These two floats sho be connected by suitable wires to a differential gauge, showing loss of head.

12. *Selection of source of water.*—You have pipes so that can apply water to the filters drawn either from the New Fc inlet or from the impounding reservoir. The water in the impou

ing reservoir had a very vigorous growth of algæ in it yesterday. This growth clogs the filter sand and makes frequent cleaning necessary, and you are also in danger of having trouble with tastes and odors in the water from it. I would, therefore, plan, during such periods of growth, to by-pass this reservoir and to draw water as far as possible from New Forge. The reservoir water, however, is safe from the standpoint of possibility of disease producing germs, and I would arrange to use that after heavy storms, when the New Forge water would be most likely to contain contamination of this kind.

13. *Use of raw water during construction.*—With only one unit it will be necessary to supply the city with raw water for a week or perhaps longer while the surface is being prepared and new sand is applied. I think the work could be done in this length of time if all preparations were made in advance and a good deal of the sand secured and washed before the resanding was commenced. I am satisfied that the quality of the water is such that with the selection of a suitable time for doing this, and due care in all respects, it will be perfectly safe to supply the city with raw water while this is being done. In fact, I believe that the quality of the water drawn from this source is better than that from many of the public water supplies of the State at the present time.

I would by all means apply the additional sand to the filter without undue delay and give every attention to keeping it in efficient service. It greatly improves the quality of your water, and is a most useful and important part of your plant.

I inclose analyses of two samples of sand which I brought down yesterday. I also inclose account for services.

Very truly yours,

ALLEN HAZEN

ALBANY, N. Y., *October* 5, 1907.

MR. ROBERT J. HARDING, *Superintendent of Public Works, Hudson, N. Y.:*

DEAR SIR:— Replying further to your letter of September 6th, in which you inclose a copy of a report of Mr. Allen Hazen upon the improvements to the sand filtration plant of your water system, I beg to say:

I am very pleased to note that you have secured the services of a well-recognized expert for so important an improvement, and after reading the report of Mr. Hazen I am pleased to say that I thoroughly approve of it on the whole. As stated to you in previous correspondence, however, it is quite essential that cities and towns in this State be protected at all times from possible infection, and that, as I pointed out to you before, and Mr. Hazen again points out in his report, there will be times when unfiltered water will have to be supplied to the residents of your city.

These periods would occur not only at the time suggested by Mr. Hazen in his report, during the period of construction, but would also occur at times when the single unit would have to be cleaned. These periods might come frequently at certain seasons of the year and at such times it will be necessary to supply the city with raw water from your storage reservoir or from the stream. It is also possible that in the future there might be other occasions in addition to that of cleaning when a single unit might necessarily be out of service.

I would, therefore, in again calling attention to this important feature and while realizing the economic considerations suggested by Mr. Hazen as to the filter being old and not warranting any improvements except those of the most urgent kind, emphasize the importance of protecting your water supply at all times, and since your filter, old as it is, may be used for a great many years, point out the desirability of having more than one unit.

While not, therefore, urging the division wall against the advice of your expert, Mr. Hazen, I hope that your city will have funds sufficient to so alter or extend your plant that it may be operated so as to supply filtered water to your citizens at all times.

Very respectfully,

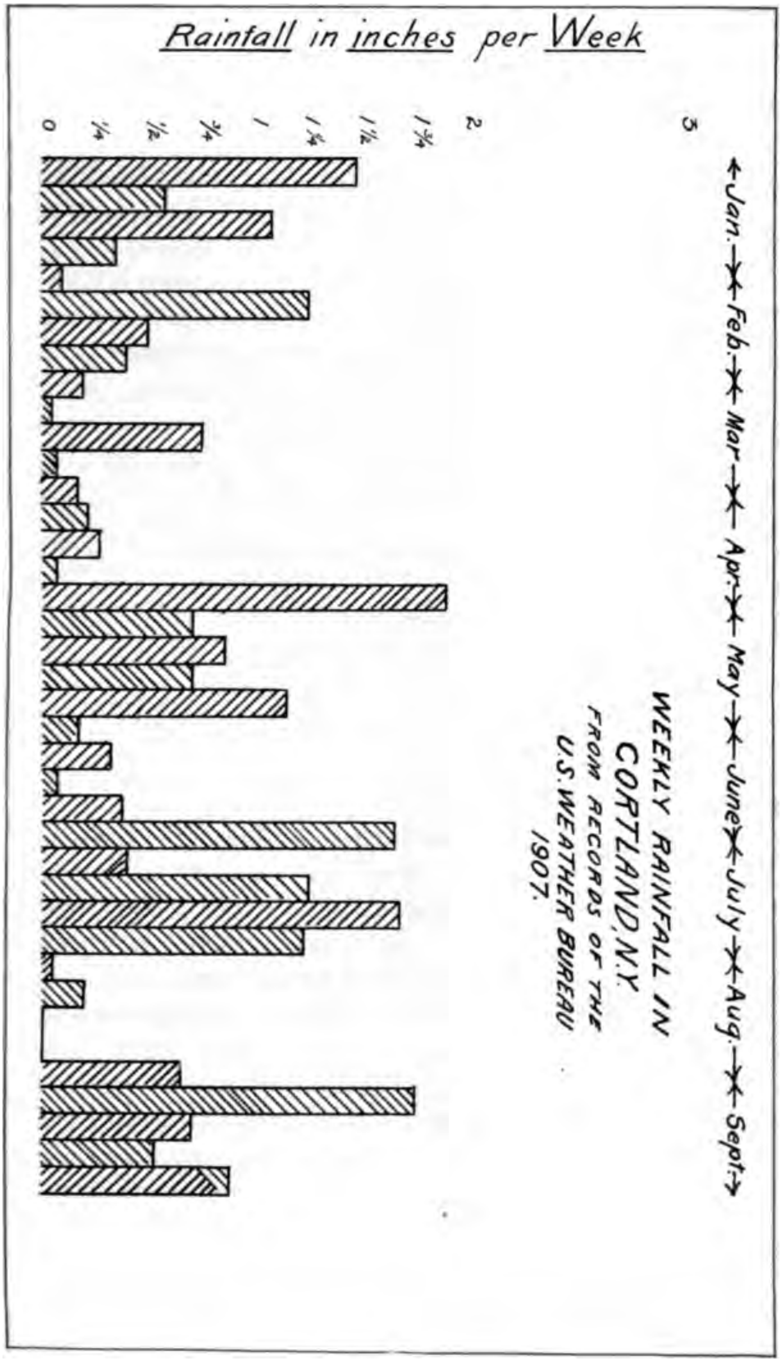
EUGENE H. PORTER,
Commissioner of Health

sketch) from which water is pumped into the reservoir. It is stated that the well is about fifty feet deep in gravel, and that, in driving, it passed through two strata of clay. The man in charge of the water system reported that he had pumped once or twice through the summer, and that since October 7th he had not pumped. Unless, therefore, the well had become suddenly infected, there is no cause of the fever in the method of supply, that is, the sudden introduction of well water could not have caused the outbreak, particularly since, as pointed out above, only two families supplied, out of five hundred, are affected.

It is said, however, that a chemist of Watertown, whose family are residents of Moravia, has from personal interest often examined the city water and has frequently found colon bacilli therein, and that his mother, on account of her son's warnings habitually boils the city water. The results of an examination of the city water, spring water, and well water separately, are given on the attached sheets, the comments of the director of the laborator being attached, also analysis of the chemist just referred to.

Milk Supply

There are four milkmen supplying milk to residents of Moravia but of the cases noted on the map, three only had milk from the same man. The Thomas case had milk from their own cow, the families outside the village all had dairies, and milk from the own herds, the Parkhurst family had milk from a neighbo (Adams), the Fox boy, the Fowler girl, and the Whipple case a had milk from a milkman named Aspel; but, in view of the fa that the Fox boy was taken ill on July 14th, and that no oth case occurred until October 10th, and that it is probable that th Whipple case was contracted before coming to Moravia; and i view of the fact that Aspel has the longest route, I think that th possibility of a milk infection can be eliminated. At the same time it is worth noting that Aspel in the summer purchased part of his supply from the Robinson farm, north of the village (see map), and, although the health officer prohibited this as soon as fever was found to exist there, the cases in the village might possibly have come through the milk from the same source as those on the Robinson farm.


Rainfall in inches per Week
0
1/4
1/2
3/4
1
1 1/4
1 1/2
1 3/4
2
3
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
WEEKLY RAINFALL IN
CORTLAND, N.Y.
FROM RECORDS OF THE
U.S. WEATHER BUREAU
1907.

Atmospheric Conditions

l enquiry was made as to food, which might have been
such as oysters, celery, etc., but no common source of
was to be found. There is, however, a most striking
ce in the fact that all the patients except the Fox boy
en sick within a few days of October 12th. There seems
cause for such coincidence except in the atmospheric con-
The month of August was an unusually dry month, the
fall as recorded at the office of the United States Weather
t Cortland being 37 hundredths of an inch, 3.68 inches
e normal, the average August rainfall for the past 40
that station being 4.05 inches (see diagram). The effect
as to lower the ground water level generally, a fact which
all the wells of that vicinity. The first week in Sep-
eavy rains began, lasting through the month, the rain-
g .9 of an inch greater than the normal. The effect of
y rain following the drought would naturally be to wash
ough the soil any contaminating influences which might
o be there. With this possibility in mind it is interest-
te the following possibilities of contamination.

Possible Sources of Contamination

homas well is shallow, only about twenty feet deep, and
mas privy vault is only about ten feet distant. Mrs.
the patient, has been suffering and under the doctor's
diarrhoea throughout the summer. In the next house,
" X " has been living a woman who contracted typhoid
Niagara Falls in the spring (convalescent in April), and
said by one of the local physicians, who was questioned
e case, to be a " chronic carrier."

owler well, also about twenty feet deep, is in the midst
cesspools, none more than 200 feet distant, two of which
nverted into their present use from old wells. They
e probably extend into the same stratum, and could very
stribute infection. It appears that resident in an adjoin-
e marked " X " was ill with typhoid fever a year ago, the
ing connected with one of the cesspools above referred to.

The Robinson well is known to have been contaminated with surface water, and this past summer, date unknown, Mr. Robinson built up a small ridge above the well to divert the surface water from barn and privy reaching the well. It further appears that the hired man was taken ill with typhoid fever a year ago, and was ill for some days at the Robinson farmhouse before being placed under the care of a physician. It is of further interest to find that Mrs. Robinson has been afflicted during the summer with severe diarrhoea so that she has been treated by her physician. The Alley case is plainly from the same source as the Robinson family since he had been working there at the time of the infection.

The well at the Rosenkrantz farm is about fifteen feet from privy, fifty feet from barn and about nineteen feet deep. Mrs. Rosenkrantz was, in the early summer, treated by her physician for chronic diarrhoea, the attack lasting about two months.

The Parkhurst family, using city water, were not exposed to these conditions in Moravia, but the three patients, about eighteen days before being taken sick, had together spent Sunday in Scipio village, about eleven miles from Moravia, and drank well water. I was informed that there had been in Scipio in years past numerous cases of typhoid fever, and while I could get no definite information as to more recent sickness, the fact that typhoid is apparently endemic there is highly suggestive.

The conditions at the Whitman farm and at Dates farm, from which the Whipple case came, I was not able to investigate personally, nor could I get any information concerning them.

In the matter of the possibility of the infection of ground water by surface pollution, the following may be quoted. (Savage on "The Bacteriological Examination of Water Supplies" page 53.)

"It is obvious that if the rate of addition of these excretal organisms is not higher than the rate of purification, the soil can act for an indefinite period as an efficient filter, preventing the access of harmful organisms to the water supply. The factors which can upset such an equilibrium are readily recognizable:

(1) The addition of the excretal matter may be so abundant that the soil cannot purify itself rapidly enough, and becomes

loaded with organisms, which are then washed into the water supply.

(2) The rain-fall may be excessive, thus washing the bacteria through the soil into the subsoil before the antagonism of the soil bacteria has had time to play its part."

Savage also quoted experiments made in Turin, where characteristic bacteria were placed on the ground surface and by heavy rains were washed through eight feet of soil, appearing at the city taps from the underdrains at the end of 30 days, the rain lasting eighteen days.

Robertson (Sr. Med. Jour. Jany. 8-1898) was able to recover bacillus from soils treated with weak organic solution over 300 days after the original inoculation with the typhoid bacillus.

There are also many experiments which indicate that the length of time which bacteria may survive is much less than this, but the very discordance of the experiments shows the possibility of a prolonged existence of the typhoid germ in soils of suitable temperature and moisture. Many experiments are available to show that the effect of rain is to carry bacteria, placed on the surface, down into the lower strata of the soil.

In view of the local conditions, and of the possibilities just noted, I am of the opinion that the coincidence of the cases in and around Moravia was due to polluted well supplies, the pollution being an exceptional condition due to a preceding drought, followed by a prolonged rain acting on a polluted surface.

Appended herewith will be found a copy of notes made on each case referred to above.

Respectfully submitted,
H. N. OGDEN,
Special Assistant Engineer

ITHACA, N. Y., *November* 15, 1907.

C. F. BRANDOW, M.D., *Moravia, N. Y.:*

DEAR SIR:— Replying to your letter of November 11th, addressed to Dr. Porter, State Commissioner of Health, and by him referred to me, I have to advise you that the law gives to the State Department of Health no authority to require any community to build water works or sewers, or to change existing systems, The only supervision which the State Department of Health can exercise in the matter of water supply is through the establishment of rules for the protection of the water-shed from which the supply is taken, which, even if asked for and put into effect in this case would not cover the point you refer to. The local board of health, under the law, has no jurisdiction in the matter of the water supply except in-so-far as it may offer advice. It has certainly no authority to order the water company to discontinue its supply, or a portion of its supply, even if the board feel so inclined. Property rights must always be respected as long as the use of property is such as not to become an open and public nuisance.

No one is obliged to use a city water, and everyone using it does so of his own volition and at his own peril. The local board of health may advise everyone in the community to boil the village water supply, but cannot compel them to do so unless they wish.

With this explanation of the conditions, you will see, I think, that your only hope consists in such a public agitation as will persuade the water company to close the well and develop spring water in more quantity.

I have received no statement as to the analyses of the two sources to which you refer and am not prepared to say that the above procedure on the part of the water company is a desirable one. I have only endeavored to point out to you how the conditions of which you complain may be relieved.

Very respectfully,
H. N. OGDEN,
Special Assistant Engineer

ITHACA, N. Y. *November* 15, 1907.

Dr. G. W. DODGE, *Moravia, N. Y.*:

DEAR SIR:— By direction of Dr. Porter, State Commissioner of Health, I am sending you herewith a copy of my report on the probable causes of the recent typhoid fever outbreak in Moravia.

There seems to be nothing more that the local health board can do in the matter, nor does it seem possible for the local board to supervise water supplies outside the village limits in a community. Where cesspools furnish the only method of sewage disposal, wells sunk into the same water-bearing strata must be viewed with grave suspicion, and you would do well to advise all users of wells in the vicinity of privies or cesspools to provide themselves with another supply. Further than this, so long as the well is used individually, you would have no right to go.

Very respectfully,

H. N. OGDEN,
Special Assistant Engineer

WATER SUPPLY FOR RAILROAD PASSENGERS

During the past few months an investigation has been under way to determine the source of water supply used on passenger trains of the various railroads of this State.

A communication asking for data was sent to superintendents and general passenger agents of all the passenger lines in the State of New York. In response to this inquiry reports have been received from practically all the companies and the various officials have apparently endeavored to tabulate this information accurately and have cheerfully furnished detailed reports on the water supplies used on their various roads.

The sources of supply at about fifty of the more important points of supply were verified and found to be correctly stated.

In general, the quality of the supply may be said to correspond to the quality of the water supplied to the various cities and larger villages of the State since the more important points of supply are the cities and larger villages and in almost every instance the source of supply at these points is the public water supply. The traveling public, therefore, is clearly concerned in the improvement of the public water supplies of the cities of this State and should welcome every move made toward the betterment of these supplies.

SYRACUSE

ALBANY, N. Y., *August* 7, 1907.

Dr. EUGENE H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Pursuant to your instructions sent to us as the result of a request from Dr. D. M. Totman, the health officer of the city of Syracuse, asking that the Department make an inspection of Skaneateles lake, the source of the water supply of the said city, and advise the city officials as to the best method of procedure to be adopted to protect this supply, we beg to report the results of our visit to Syracuse on August 2 and 5, 1907.

On August 2d, in company with Mayor Allan C. Fobes, Health Officer D. M. Totman, Mr. H. C. Allen, City Engineer, Mr. F. N. Westcott, Commissioner of Public Works, D. T. Friedrichs, Deputy Commissioner of Public Safety, J. P. Maloney, Health Inspector, G. L. Hanett, Inspector of watershed and W. W. Waite, the City Chemist and Bacteriologist, we proceeded by boat to traverse the entire length of Skaneateles lake noting carefully the conditions along the shores. No attempt was made to visit all the cottages at which improvements or changes might be necessary, but enough of these places were visited and a sufficient number of the different types of conditions threatening pollution were inspected so that an intelligent idea was obtained of the entire situation. As there are a number of reports on file in the Department describing Skaneateles lake and the surrounding country made in previous years, no attempt will be made in this report to go into detail on this subject. The question presented is simply one of the best method of procedure to properly and thoroughly protect the water supply of the city of Syracuse from any possible contamination.

There are numerous barnyards, pig-pens, cottages with outhouses, etc. located at varying distances from the water along the shores of the lake and on small streams entering the lake, with which the city officials will be forced to deal. A set of rules and regulations for the protection of the waters of Skaneateles lake were adopted by the State Board of Health on February 28, 1896, but it is our opinion, after a careful study of these rules and a comparison with the conditions existing upon the lake, that they are too indefinite and not comprehensive enough to enable the city authorities to take the necessary steps that may be required. The rules are not sufficiently specific as to the distances from the lake and water courses from which certain forms of possible contamination should be removed and there are a number of matters which are covered in the rules now adopted by the Department which were omitted in these old rules. We would therefore recommend a revision of the rules by the annulment of the old rules and the adoption of new ones more definite and specific as to the subject matter and as to the distances prescribed, in order that the city officials may be better enabled to proceed along the lines of maintaining the sanitary conditions at the high point at which they should be maintained.

There is no doubt but that the officials of the city charged by law with the duty of protecting the water supply are thoroughly in earnest in their efforts and we have the assurance that any recommendations made by this Department will be promptly and thoroughly carried out. Thorough and careful inspections have been made of the watershed by inspectors in the employ of the city and much assistance was rendered by them in pointing out the sources of possible contamination about the lake.

After carefully considering the questions involved which have been more thoroughly explained to you verbally, we would further recommend:

That, until the watershed is in a entirely satisfactory condition the two inspectors now employed by the city be maintained to make regular patrols over the watershed.

That, after the watershed has been placed in a thoroughly satisfactory condition, at least one inspector be employed continually for the purpose of such patrol.

That in the case of property owners or tenants whose privies are situated less than 150 feet by horizontal measurement from the high-water mark or top of precipitous bank of Skaneateles lake where a satisfactory system of sewage disposal is not already in operation or where tight receptacles have not already been provided, the necessary cans be provided by the city of suitable weight and size, and that it be the duty of the inspectors to see that the property owners remove and empty these cans at regular intervals.

That property owners and tenants be required to use dry earth or ashes which they shall provide, so that the contents of the cans may be inoffensive. That the contents of the cans as removed shall be disposed of on land and at least 1,000 feet from the high-water mark or top of the precipitous bank of Skaneateles lake or 1,000 feet of any stream discharging into the said lake. That none of said cans shall be removed or collected by the use of boats.

That privies located on the watershed and more than 150 feet from the lake shore be moved by the city of Syracuse if necessary, so that they shall be at least that distance from the water's edge of any and all streams running into the lake.

That the city of Syracuse immediately make arrangements with the owners or tenants of farmhouses having barns or manure piles, the drainage from which flows in a concentrated stream into any tributary of the lake or into the lake itself, or if said barns or manure pits be not more than fifty feet of the edge of the lake or of the waters of any tributary thereof; whereby in consideration of the construction by the city of Syracuse of concrete manure pits the owners or tenants shall agree to deposit manure in no other place and further agree to arrange stall drains so that all animal urine shall be led into the manure pits.

That all hog-pens within 100 feet of the high-water mark or top of bank of lake or of any tributary thereto be moved back to such a distance that the drainage does not proceed in a concentrated stream into the waters and if any hog-pen more than 100 feet from the water of the lake or tributary is so located that drainage therefrom is in a concentrated stream, that such drainage be cut off by a furrow by which it may be dissipated on the land; such improvement to be made at the expense of the city.

That any private sewers found discharging into the waters of the watershed be reported to the State Department of Health, who should at once cause the same to be discontinued or the contents thoroughly purified.

That any refuse or waste matter from any mills, factories, creameries or other manufacturing establishments shall be reported to the State Department of Health who should cause the same to be discontinued or properly treated.

That the city of Syracuse after making a proper and reasonable effort to remove all surface or other drains running from kitchen sinks, cesspools, etc. and discharging into Skaneateles lake and its tributaries, proceed through its city attorney to impose and collect the penalties specified in the rules for each offense.

That any violations of rules 8, 9, 11, 12, or 13 discovered by the inspector shall be reported to the city attorney for the imposition and collection of the penalty provided by rule 14.

We further recommend that daily bacteriological analyses of the city water supply and weekly chemical analyses of the said supply be made by the city chemist.

It may be said that the city of Syracuse has probably the finest natural source of water supply of any city of the State of New York and that the highest degree of care should be exercised to keep the water of the lake in the purest possible condition and prevent any contamination. In our judgment, the danger of any contamination which might threaten the health of the people of the city of Syracuse is, by reason of the natural conditions existing there, very remote. A sewage disposal plant for the hotel at Glen Haven is being constructed and the city proposes to purchase considerable ground at Fairhaven — both at the upper end of the lake — as a result of which improvements the conditions there will be excellent. Steamboats on the lake, we are advised, are not allowed to deposit any excreta directly into the waters of the lake, but are compelled to maintain tight closets. With the suggested changes made and with the adoption of a new set of rules for the protection of the water supply, the city of Syracuse will, in our judgment, have a water supply which is little short of ideal.

The time may come, however, when the city of Syracuse, to insure proper disposal of the contents of the privies and of the garbage on the watershed, will be obliged to make suitable provision for the collection and disposition of same, and it is therefore desirable that the changes and renovations made in any buildings be done with this in view.

Respectfully submitted,
H. N. OGDEN,
Sanitary Engineer
A. H. SEYMOUR,
Secretary

TICONDEROGA

TICONDEROGA, N. Y., *April* 22, 1907.

State Commissioner of Health, Albany, N. Y.:

DEAR DOCTOR:— Inclosed find reports of six cases typhoid, which have developed here in the last two weeks; there are several other suspicious cases, but not developed sufficiently to be positive yet. I would like to have container sent up here and will send down some of the Lake George water for bacteriological examination; it would also afford us much satisfaction if an inspector could be sent up here and urge our village board of trustees to do something about the changing of the present water supply (of which you have a full report).

Our village board of health has condemned the present water supply.

Respectfully yours,
G. H. BEERS,
Health Officer

ALBANY, N. Y., *April* 30, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I beg to transmit herewith report of Mr. H. B. Cleveland, Assistant Engineer, regarding a recent outbreak of typhoid fever at Ticonderoga.

The report is full and explicit and contains recommendations and suggestions necessary to improve the conditions and otherwise reduce the danger from a repetition of this outbreak.

Very respectfully,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 27, 1907.

THEODORE HORTON, *Consulting Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR:— In accordance with your directions, I visited Ticonderoga on April 26 for the purpose of investigating local conditions in relation to a typhoid fever epidemic, and to ascertain if he orders had been complied with which were issued by the Department in January, 1906, and directed to the president of the board of health of the town of Ticonderoga, and to the president of the board of health of the village of Ticonderoga.

A reference to my report of a similar investigation at Ticonderoga, dated January 6, 1906, and to Prof. Olin H. Landreth's report to the Commissioner containing certain recommendations which were embodied in the orders referred to above, will present the facts in the case.

As stated in the communication from the board of health of the town of Ticonderoga, dated January 26, 1906, the order from this Department directed to said board, relating to the removal of infectious matter from the drainage area near Water street which is tributary to the stream above the intake of the water supply system, was fully and immediately complied with.

Since that time the conditions along and near the banks of Ticonderoga creek above the intake have been inspected from time o time and the district has been kept in a fairly sanitary condiion.

However, the condition still exists, as outlined in the former report, of upward of forty dwellings each having outside privies ocated on a strip of land each side of Water street from 200 to 00 feet wide, drainage from which, for a distance of three-quarters of a mile above the intake of the Lake George supply main, reaches Ticonderoga creek.

The sewer from the Alexandria hotel near Bridge street, referred to in former report, has since been disconnected, and the wastes, which consist only of bar wash water and sink water, were discharged into a cesspool. But, on account of the character of the soil, the cesspool overflowed, so that the sewer was reconnected and the wash and sink water is still discharged into the creek at a point opposite the intake of the water supply.

Respecting the order of January 22, 1906, issued by the Department to the president of the board of health of the village of Ticonderoga, the president of the board of health states that the matter of improvements to the water supply was immediately brought before the village trustees in the manner suggested by this

Department, and at a later date, the Lake George supply was condemned by the board of health and the village trustees notified of such action.

Up to the present time, no definite action has been taken by the village authorities leading to the improvement of the water supply for the purpose of eliminating the insanitary conditions existing at the time of the former investigation or leading to the establishment of a permanent and modern system of sewerage and sewage disposal in the village, as recommended by this Department.

During 1906 an eight-inch pipe was set in the embankment at the outlet of Goose Neck lake for the purpose of roughly determining the yield from this lake, but no positive results were obtained, since a record was not kept of the flow to show the quantity which this lake would supply should a main be laid to supplement the Chilson Hill supply.

So that the matter stands as in January, 1906 — two water supplies from two sources and distributed by parallel mains in many streets. The one supply from the Chilson Hill reservoir, fed by Arthur brook, being surrounded by sanitary conditions which leave little or no doubt as to the purity of the water, the other derived from the Ticonderoga creek, the outlet of Lake George, the intake being located at such a point as to leave no doubt that the supply is now and has been for years in great danger of pollution, if not actually contaminated, by reason of the insanitary conditions on the watershed immediately tributary to the stream above the intake.

As stated in my former report, one of two propositions may be followed out in remedying the undesirable conditions noted:

First. The present Lake George main may be continued south from the present intake, either in the stream or along either bank, for a distance of about one mile, past the populated district in the town of Ticonderoga and into deep water in Lake George at some point near Prisoners Island. The nearest settlement above this point is Baldwin, about one mile south, where fifteen or twenty summer camps are located.

Second. The Chilson Hill high-level system may be extended so as to tap a supply of water sufficient for the entire consumption f the village. (This second plan is discussed in the former reort.)

The relative merits of these two plans call for investigation and tudy by the village authorities. Before either proposition is dopted for the improvement of the water supply, expert advice hould be sought in order to guarantee the permanence and econmy of any improvements proposed, since many of the problems ivolved are of a technical nature and require experienced enineering skill for their proper solution.

The question of sewerage is at the same stage described in the ormer report except that the discharge of sewage into the natural ivines has increased and more and more complaints are continully being received by the board of health against the insanitary onditions resulting from such discharge. If the proposition for he installation of a sewer system were to be presented to the taxayers in a form which proposed that only certain parts of the ystem would be built at first and that all such existing sewers hich could be incorporated into the general plan would be acpted by the village and the owners reimbursed for the cost of onstruction, as provided by the Village Law relating to sewer sysms, it was the opinion of some of the village officials that sewerge improvements could be more readily brought about.

The necessity of improved modern sewerage in the village is ery evident and the sanitary conditions would be vastly improved ith a reasonable outlay if the work should be undertaken in the roper way.

With respect to the present epidemic of typhoid in the village, even cases have been reported, one proving fatal; the cases are ostly children attending the Alexandria school, one of the graded chools of the village, and living within one-half mile of the school, This school is supplied generally by water from the Chilson Hill ystem, but about six weeks ago, the Chilson supply being low, vater was pumped from the Lake George supply into the Chilson Hill high-level service.

When Lake George water is pumped into the high-level system, he surplus over consumption reverts to the Chilson Hill reservoir. It is thus seen that the influence of any infection which may occur in the Lake George water would be as liable to produce sickness in one part of the village as another.

The date of onset of the cases reported ranges from April 5 to April 12, 1907, and, allowing for the period of incubation, would seem to indicate that the Lake George water which was pumped into the entire distributing system might have been the cause of infection.

On the other hand, a break in the water tap supplying the school, which occurred this spring, may have caused the outbreak of typhoid by reason of the condition of the ground water and the subsoil, since cesspools are numerous in the vicinity.

There have been sent to Health Officer Beers from the State Laboratory, some jars for samples of water from the Lake George outlet and from the Chilson Hill supply. It is arranged with Dr. Beers that samples of the Lake George water for bacteriological examination shall be sent to the State Laboratory at frequent intervals of, say, two weeks, for a time.

The village officers are as follows: President J. H. Rand; Trustees, Denis Towns, Edward Stanton; Village Clerk and Secretary of the Board of Health, W. G. Wallace; Village Board of Health: President, H. W. Tredway; Members, M. J. Wilcox, Lyman Malcolm; Health Officer, G. H. Beers, M. D.; Town Board of Health: Supervisor, J. W. Bullen; Town Clerk, W. Coates; Justices of Peace, Orville Philips, R. V. Smith, H. Belden; Citizen member, Dr. N. D. Peck; Health Officer, G. H. Beers, M. D.

Respectfully submitted,
H. B. CLEVELAND,
Assistant Sanitary Engineer

ALBANY, N. Y., *June* 6, 1907.

MR. J. H. RAND, *President, Board of Trustees Ticonderoga, N. Y.:*

DEAR SIR:— I beg to call your attention to the dangerous condition of the water supply of your village as a result of the continued pollution of Lake George in the vicinity of the intake, and to the necessity of taking immediate action toward remedying these conditions, which have been a menace to the health and a cause of considerable typhoid fever among the residents of your village.

The conditions with respect to the pollution of your water supply were thoroughly investigated more than a year ago, and as a result of the investigation recommendations were made to your village with respect to carrying out certain improvements to your water supply and to the introduction of a modern system of sewerage. Your attention was at that time especially called to the possible danger of any delays in these improvements, but, up to the present time, as shown by the accompanying report of Assistant Engineer H. B. Cleveland, upon his recent investigation of the conditions at Ticonderoga, very little has been accomplished.

As a result of the failure to carry out the recommendations of this Department, made more than a year ago, the health of your village has continued to suffer, and only very recently has Ticonderoga been visited by an epidemic of typhoid fever, the cause of which was found to be clearly an infection of the portion of your water supply taken from Lake George. During the investigation of this epidemic by representatives of this Department the conditions of pollution were again inspected, and also analyses of your water supply were made at various points, to determine the degree of its pollution.

A copy of the report of Mr. H. B. Cleveland, Assistant Engineer, upon his investigation of the pollution of your supply and the possibilities of its improvement, together with the chemical and bacteriological analyses made by the State Hygienic Laboratory are herewith inclosed. These reports and analyses indicate clearly that the water supply of your village has been and is dangerously polluted, and that this pollution was the cause of the recent outbreak of typhoid fever in your village. This report, as well as the report of the Department in 1906, clearly shows that the continued menace to the health of your village cannot be effectually removed until means are provided for a better and purer water supply, or a complete removal of all pollution, which is only practicable by the installation of a modern system of sewerage.

In view, then, of the serious condition which has and does now exist with respect to pollution of your water supply, the consequent ravages which these conditions have exerted upon the health of your citizens, and the methods and means which are or can be procured at reasonable cost to secure a supply of pure and wholesome water, you are, therefore, urgently and emphatically recommended, as president of the board of trustees of your village, to convene said board at once and to take such action as may be necessary:

1. To secure without delay a supply of pure and wholesome water adequate for the needs of the entire village, either by an extension of the present Chilson Hill supply or from some other unpolluted source, as may be found upon careful investigation by a competent expert to be most expedient.

2. To improve at once the portion of the present water supply of the village derived from Lake George, as a temporary relief until a new and purer supply is secured, by removing all sources of pollution that may either directly or indirectly contaminate the portion of the water of the lake contributing to this portion of the village supply.

You are, further, requested to report to the State Department of Health on or before July 1, 1907, as to what action has been taken by your board of trustees in compliance with this urgent appeal for protection of the health of the citizens of your village.

Respectfully yours,

EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *July* 9, 1907.

MR. JAMES H. WRENN, *Village President, Ticonderoga, N. Y.:*

DEAR SIR:— I am at a loss to understand the attitude of the village authorities of Ticonderoga. This Department has pointed out to you the insanitary conditions now existing in connection with your water supply.

The records show deaths from typhoid fever with the inevitable nonfatal cases of sickness which accompany that disease and it seems to make no impression on the survivors. That village authorities, in this age of enlightenment, when intelligent men thoroughly understand that typhoid fever is the direct result of polluted drinking water, can meekly acquiesce in conditions which they know are responsible for the spread of that disease is beyond my comprehension.

This Department has on several occasions pointed out to you the necessity for improving your water supply and yet it would seem that for some reason the village authorities fail to act.

I should be very glad if, as president of the village, you will inform me of the reason for this inaction before I take further steps in the matter.

Respectfully yours,
EUGENE H. PORTER,
Commissioner of Health

DOLGEVILLE, N. Y., *July* 27, 1907.

State Commissioner of Health, Albany, N. Y.:

DEAR SIR:— I called at your office on July 15th regarding water supply for Ticonderoga, N. Y., and promised Mr. Horton, Consulting Engineer, also Prof. Ogden, that I would write the Department later regarding what the village would do in securing a better water supply.

The village board has authorized me to make a thorough investigation of the different sources from which a supply may be secured and submit a report recommending a supply and giving estimated cost, etc.

I expect to take this work up August 1st and hope I shall be able to recommend a supply entirely satisfactory to your Department.

Very respectfully,
CHAS. E. COLLINS

VALATIE

VALATIE, N. Y., *April* 24, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I have to-day taken a sample of water from the outlet of Kinderhook lake, for chemical analysis, also one sample from same source for bacteriological analysis. Besides these, two other samples for bacteriological analysis were taken from our water supply, one being taken after the stream reaches this village and empties into a pond and the other one was taken from a faucet.

It is not a question whether this water supply is contaminated or not, as we know it is, but rather it is a question of degree.

Within the town of Kinderhook, along this stream (but not within my jurisdiction) I have to-day seen privies and barnyard manure heaps all awash in the waters of this stream.

I have information that overflowing cesspools are draining into it also. To know the full extent of pollution of this stream, one must travel on foot several miles, around the entire lake, and from there along the stream which is the outlet, until reaching this village. Please advise, how I am to proceed in regard to such territory as does not lie within my jurisdiction.

Respectfully yours,

W. J. BREWSTER

ALBANY, N. Y., *May* 29, 1907.

Dr. W. J. BREWSTER, *Health Officer, Valatie, N. Y.:*

DEAR SIR:— Replying to your letter of April 24th with respect to analyses of your water supply and means for protection from pollution of the same, I beg to say:

Copies of the analyses made by the State Hygienic Laboratory were recently forwarded to you by Dr. Pease on May 17, 1907. These analyses indicate that not only is there pollution upon the watershed of your water supply but from the presence of B. Coli that this pollution is of sewage origin. Although some samples showed more pollution than others and that in some of them the pollution may not have been of sewage origin, yet, taking them as a whole they show a sufficiently large amount of pollution to warrant some misapprehension.

Under the circumstances, I would recommend that a thorough inspection of the watershed be made with a view of locating and removing all sources of pollution. As to the best method of proceeding with this work, I would suggest as the first thing to be done that water rules be enacted by this Department for the protection of the watershed of your supply. This would afford more specific protection and make easier the work of systematically inspecting the watershed and give more authority in removal of cases of violators. It would also solve the question of jurisdiction over localities outside of your village or township, since these rules would apply to the whole watershed regardless of village or township lines.

I would then finally suggest that this matter be taken up between your board and the local officials having in charge the water supply of your village to consider the advisability of making application to this Department for enactment of water rules. When this is done, and I receive from you such an application, I will consider at once the preparation and enactment of such rules and regulations.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

WELLSVILLE

ALBANY, N. Y., *April* 30, 1907.

MR. WILLIAM DILLON, *President Board of Health, Wellsville, N. Y.:*

DEAR SIR:— Replying further in the matter of allowing a direct connection of the Genesee river with the Wellsville water supply system for the purpose of using the Genesee river water during emergency for fire protection, I beg to transmit herewith the report of our consulting engineer in regard to this matter.

I indorse herewith the suggestions and the conditions upon which he recommends the use of such water from the Genesee river for emergency use and believe that if the restrictions are carried out carefully there should be practically no danger from such a procedure.

Respectfully yours,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *April* 30, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health*,
Albany, N. Y.:

DEAR SIR:— In regard to the request of the Wellsville authorities as to the danger of taking water from the Genesee river for emergency fire purposes, and as to the practicability of allowing the use of such emergency water under proper restrictions, I beg to report as follows:

There is always danger if a polluted supply is used, even for temporary purposes, on the grounds that during such times the water is used for drinking purposes, and that for some time following the use of such emergency supply the water still remains in the pipes and is delivered to consumers. The danger is, of course, proportional to the amount of pollution, which under some conditions may be very small.

In the case of Wellsville it appears that the Genesee river at this point is not so badly polluted that there will be any great danger from occasional use of this water, provided:

First. That the cost of sufficient storage for fire protection cannot be met by the village or the water company.

Second. That the sewage pollution by the people of the oil refinery located some one-half mile above the village, and which now discharges directly into the river above the intake, is removed by the enforced use of privy vaults or by sewage purification.

Third. That the valve for the emergency connection between the river water and the water supply system be sealed by representatives of the village, preferably the board of health, which seal is always to be open for inspection.

Fourth. That this connection never be opened except in case of fire and that immediately after its use the water pipe system be flushed of the water used from the Genesee river and the valve connection again sealed.

It would seem to me that if these precautions are taken and considering the present condition of purity of the Genesee river and the proposed removal of existing pollution, that there should be very little if any danger from the emergency use of this water during times of fire.

I should recommend that the board of health of the village of Wellsville and the Wellsville water company be so advised.

Respectfully submitted,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 30, 1907.

MR. C. P. NIEBECKER, *Wellsville Water Company, Wellsville, N. Y.:*

DEAR SIR:— I beg to acknowledge the receipt of your letter of the 25th and to enclose herewith a letter that has just been written to the president of the board of health with accompanying report of our Consulting Engineer, with regard to the use of the Genesee river water for emergency during times of fire, and the restrictions under which the use should be allowed.

The details as to the arrangements between the water company and the village authorities I assume can be satisfactorily and amicably adjusted by the parties interested. I should be glad to receive, however, any further comments from you in regard to this matter.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

WELLSVILLE, N. Y., *May* 25, 1907.

DR. EUGENE H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I beg to acknowledge receipt of your letter to our Mr. Niebecker, in which was enclosed a copy of your letter to Mr. Dillon, the president of the local board of health. As Mr. Niebecker has been engaged in other work I believe he has not acknowledged the receipt of same and the letter has been turned over to me.

I have gone over, with Mr. Dillon, the recommendations and arrangements as suggested by you and will be able, I think, to soon settle the controversy in regard to the water supply at Wellsville.

Thanking you for the attention and consideration you have given the matter, I am,

Yours truly,
H. C. AMSBARY,
Superintendent

WHITEHALL

A joint investigation of a typhoid fever epidemic at Whitehall, due to the pollution of the water supply, was made during the year by the Hygienic Laboratory and the Engineering Division. a report of which will be found in the report of the Hygienic Laboratory.

PREPARATION OF RULES FOR THE PROTECTION OF WATER SUPPLIES

Upon request of the proper authorities and in accordance with the provisions of section 70 of the Public Health Law, the following sets of rules and regulations for the protection from contamination of public water supplies were enacted by the Commissioner of Health during the year.

Abstract of the New York State Public Health Law providing for the protection from contamination of the public water supplies throughout the State. Chapter 661 of the Laws of 1893, as finally amended by chapter 582 of the Laws of 1906.

" § 70. *Rules and regulation of department.*— The state department of health may make rules and regulations for the protection from contamination of any or all public supplies of potable waters and their sources within the state. If any such rule or regulation relates to a temporary source or act of contamination, any person violating such rule or regulation shall be liable to prosecution for misdemeanor for every such violation, and on conviction shall be punished by a fine not exceeding two hundred dollars, or imprisonment not exceeding one year, or both. If any such rule or regulation relates to a permanent source or act of contamination, said department may impose penalties for the violation thereof or the noncompliance therewith, not exceeding two hundred dollars for every such violation or noncompliance. Every such rule or regulation shall be published at least once in each week for six consecutive weeks, in at least one newspaper of the county where the waters to which it relates are located. The cost of such publication shall be paid by the corporation or municipality benefited by the protection of the water supply, to which the rule or regulation published relates. The affidavit of the printer, publisher or proprietor of the newspaper in which such rule or regulation is published may be filed, with the rule or regulation published, in the county clerk's office of such county, and such affidavit and rule and regulation shall be conclusive evidence of such publication, and of all the facts therein stated in all courts and places.

"§ 71. *Inspection of water supply.*— The officer or board having by law the management and control of the potable water supply of any municipality, or the corporation furnishing such supply, may make such inspection of the sources of such water supply, as such officer, board or corporation deems it advisable, and to ascertain whether the rules or regulations of the state department are complied with, and shall make such regular or special inspections as the state commissioner of health may prescribe. If any such inspection discloses a violation of any such rule or regulation relating to a permanent source or act of contamination, such officer, board or corporation shall cause a copy of the rule or regulation violated to be served upon the person violating the same, with a notice of such violation. If the person served does not immediately comply with the rule or regulation violated, such officer, board or corporation shall notify the state department of the violation, which shall immediately examine into such violation; and if such person is found by the state department to have actually violated such rule or regulation, the commissioner of health shall order the local board of health of such municipality wherein the violation or the noncompliance occurs to convene and enforce obedience to such rule or regulation. If the local board fails to enforce such order within ten days after its receipt, the corporation furnishing such water supply, or the municipality deriving its water supply from the waters to which such rule or regulation relates, or the state commissioner of health or the local board of health of the municipality wherein the water supply protected by these rules is used, or any person interested in the protection of the purity of the water supply may maintain an action in a court of record, which shall be tried in the county where the cause of action arose against such person, for the recovery of the penalties incurred by such violation, and for an injunction restraining him from the continued violation of such rule or regulation.

"§ 72. *Sewerage.*—When the state department of health shall, for the protection of a water supply from contamination, make orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewerage, or a change thereof, in or for any village or hamlet,

: incorporated or unincorporated, or the execution of vill require the providing of some public means of removal fication of sewage, the municipality or corporation owning er works benefited thereby shall, at its own expense, con- ınd maintain such system of sewerage, or change thereof, vide and maintain such means of removal and purification ıge and such works or means of sewage disposal as shall oved by the state department of health. When the execu- any such regulations of the state department of health will u or require the removal of any building or buildings, the pality or corporation owning the water works benefited shall, at its own expense, remove such buildings and pay owner thereof all damages occasioned by such removal. the execution of any such regulation will injuriously affect operty the municipality or corporation owning the water benefited thereby shall make just and adequate compensa- r the property so taken or injured. Until such construction ıge of such system or systems of sewerage, and the provid- such means of removal or purification of sewage, and such r means of sewage disposal and the removal of any build- e so made by the municipality or corporation owning the works to be benefited thereby at its own expense, and until nicipality or corporation owning the water works benefited ıake just and adequate payment for all injuries to property r all injuries caused to the legitimate use or operation of roperty, there shall be no action or proceeding taken by ch municipality, officer, board, person or corporation against rson or corporation for the violation of any regulation of te department of health under this article, and no person oration shall be considered to have violated or refused to ny such rule or regulation. The owner of any building noval of which is occasioned or required, or which has been d by any rule or regulation of the state department of made under the provisions of this article, and all persons rights of property are injuriously affected by the enforce- f any such rule or regulation, shall have a cause of action t the municipality or corporation owning the water works benefited by the enforcement of such rule or regulation, for all damages occasioned or sustained by such removal or enforcement, and an action therefor may be brought against such municipality or corporation in any court of record in the county in which the premises or property affected is situated and shall be tried therein; or such damages may be determined by a special proceeding in the supreme court or the county court of the county in which the property is situated. Such special proceedings shall be commended by petition and notice to be served by such owner upon the municipality or corporation in the same manner as for the commencement of condemnation proceedings. Such municipali or corporation may make and serve an answer to such petition as in condemnation proceedings. The petition and answer shall set forth the claim of the respective parties, and the provisions of the condemnation law shall be applicable to the subsequent proceedings upon the petition and answer, if any. Either party may, before the service of the petition or answer respectively, offer to take or pay a certain sum, and no costs shall be awarded against either party unless the judgment is more unfavorable to him than his offer."

Concerning the obligation of water corporations or departments to provide for the cost of, or for the making of changes or improvements demanded by the rules, but not specifically mentioned in section 72 of the above law, the State Attorney-General has rendered an opinion from which the following is abstracted:

"In my opinion the proper and only lawful construction which can be placed on section 72 of the Public Health Law is that all damages and injury to the owner of any property affected by changes required to be made to comply with the rules of the Department of Health must be ascertained and paid prior to the taking possession of the property, and is a prerequisite to the enforcement of said rules in all cases except such as are a nuisance in and of themselves, in which cases the Department of Health would have power and authority outside of sections 70, 71 and 72 to abate the same. Any other construction would to my mind render the law unconstitutional. In brief, I am of the opinion that the State Department of Health, * * * can make and promulgate rules regulating and controlling the use of premises surrounding the sources in all regards, and that a person violating any of these rules can be punished as provided by the penalties, but before such punishment can be inflicted, the corporation for whose benefit the rules are made and established must pay or tender to the owner of the property affected by the enforcement of such rules an amount equal to all damages for making the changes necessary."

DOLGEVILLE

Rules and regulations for the protection from contamination of the public water supply of the village of Dolgeville, Herkimer, county, N. Y.

Rules and Regulations

The following rules and regulations shall apply to Cold creek and to the impounding and distributing reservoir of the Dolgeville water supply, supplying the public water supply of the village of Dolgeville, Herkimer county, N. Y., and to all watercourses entering or ultimately discharging into said streams or bodies of water. The term "reservoir" whenever used in these rules is intended to mean and comprise every natural or artificial reservoir, lake or pond which stores or detains water that enters or may enter the public water supply of the village of Dolgeville. The term "watercourse" wherever used in these rules is intended to mean and comprise every spring, stream, ditch, or gutter, or other watercourse of any kind, the waters of which when running, whether constantly or occasionally, eventually flow, or may flow, into the public water supply of the village of Dolgeville.

Privies Adjacent to Reservoirs or Watercourses

1. No privy, privy vault, pit, cesspool, or any other receptacle of any kind used for either temporary storage or the permanent deposit of human excreta shall be constructed, placed or maintained within two hundred (200) feet, horizontal measurement, of the high-water mark of any reservoir, or within one hundred

(100) feet of the edge, margin, or precipitous bank of any watercourse of the Dolgeville supply.

2. No privy, privy vault, pit, cesspool, or any other receptacle used for the permanent deposit of human excreta shall be constructed, located, placed or maintained with its nearest point within three hundred (300) feet, horizontal measurement, of the water line of any reservoir of the Dolgeville water supply, or within two hundred (200) feet, horizontal measurement, of the edge, margin, or precipitous bank of any watercourse of the Dolgeville water supply.

3. No privy, privy vault, pit, cesspool, or other receptacle used for the permanent deposit of human excreta shall be constructed, located, placed or maintained within any mine or mine shaft, the drainage from which, either by gravity or by pumping, flows directly or indirectly into any reservoir or watercourse of the Dolgeville water supply.

4. Every privy, privy vault, pit, cesspool or other receptacle or place used for the temporary storage of human excreta which is constructed, located, or maintained within the aforesaid three hundred (300) feet, horizontal measurement, of the high-water mark of any reservoir, or within the aforesaid two hundred (200) feet, horizontal measurement, of the edge, margin, or precipitous bank of any watercourse of the Dolgeville water supply, from which privy or other receptacle the excreta are not at once removed automatically by means of suitable water-tight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided, shall be arranged in such manner that all such excreta shall be received temporarily in suitable receptacles or vessels which shall at all times be maintained in an absolutely watertight condition and which will permit of convenient removal to some place of ultimate disposal as hereinafter set forth.

5. Every privy, privy vault, pit, cesspool or other receptacle used for the temporary or permanent storage of human excreta which is constructed, located, or maintained within any mine or mine shaft, from which privy or receptacle the excreta are not at once removed automatically by means of water-tight pipes or conduits to some proper place of ultimate disposal, as hereinafter

provided, shall be arranged in such manner that all such excreta shall be received in suitable vessels or receptacles which shall at all times be maintained in an absolutely water-tight condition and which will permit of convenient removal to some place of ultimate disposal as hereinafter set forth.

6. The excreta collected in the aforesaid receptacles shall be removed and the receptacles thoroughly cleansed and deodorized as often as may be found necessary in order to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundations or floor of the privy. In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

7. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid receptacles shall, when removed, be disposed of by burying in trenches, or by thoroughly digging it into the soil in such place and manner as to effectually prevent them from being washed over the surface of the ground by rain or melting snow, and at distances of not less than five hundred (500) feet, horizontal measurement, from the high-water mark of any reservoir, or not less than three hundred (300) feet from the edge, margin, or precipitous bank of any watercourse of the Dolgeville water supply.

8. Whenever it shall be found that owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil, or surface water, or other special local conditions, the excremental matter from any privy or aforesaid receptacle, or from any trench or place of disposal, may, in the opinion of the State Commissioner of Health, be washed over the surface or through the soil into any reservoir or watercourse, then the said privy or receptacle for excreta or the said trench or place of disposal shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Department of Health.

Sewage, House Slops, Sink Waste, etc.

9. No sewage or excremental matter from any water closet, privy, or cesspool shall be led, conducted or discharged by any pipe, drain, or ditch into any reservoir or watercourse of the Dolgeville water supply, nor shall any such matter be placed, led, discharged, or allowed to escape onto the surface of the ground or into the ground below the surface within five hundred (500) feet, horizontal measurement, from the high-water mark of any reservoir, or within three hundred (300) feet, horizontal measurement, of the edge, margin, or precipitous bank of any watercourse of the Dolgeville water supply.

10. No garbage, putrescible matter, house slops, bath waters, kitchen or sink waste, refuse or waste waters from creameries, cheese factories, laundries, nor water in which milk cans, utensils, clothes, bedding, carpets, or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse of the Dolgeville water supply. Nor shall any such liquid or solid refuse or waste be thrown or discharged upon the surface of any ground or into the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse of the Dolgeville water supply within two hundred (200) feet, horizontal measurement, of the edge, margin, or precipitous bank of any watercourse of the Dolgeville water supply.

11. No clothing, bedding, carpets, harness, vehicle, receptacles, utensils, nor any thing that pollutes water shall be washed, rinsed, or placed in any reservoir or watercourse of the Dolgeville water supply.

Bathing, Animals, Manure, Compost, etc.

12. No person shall be allowed to bathe in any reservoir or watercourse of the Dolgeville water supply, nor shall any animals or poultry be allowed to stand, wade, or swim in said reservoir or watercourse, nor be washed therein.

13. No stable for cattle or horses, barn yard, hog pen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile nor compost heap, shall be located, placed,

naintained, or allowed to remain with its nearest point less than ive hundred (500) feet, horizontal measurement, from high-water mark of any reservoir, or less than three hundred (300) feet, horizontal measurement, from the edge, margin, or precipitous bank of any watercourse of the Dolgeville water supply, and none of the above-named objects or sources of pollution shall be so located, placed, maintained, or allowed to remain that the drainage, leachings or washings from the same may enter any reservoir or watercourse of the Dolgeville water supply, without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainage, leachings, or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than five hundred (500) feet before entering any reservoir, nor less than three hundred (300) feet before entering any watercourse of the Dolgeville water supply.

14. No human excrement or compost containing human excrement shall be placed, piled, or spread upon the ground, or dug or buried in the soil within a distance of five hundred (500) feet from the high-water line of any reservoir, nor within a distance of five hundred (500) feet from the edge, margin, or precipitous bank of any reservoir of the Dolgeville water supply, and no manure or compost of any kind shall be placed, piled, or spread upon the ground within three hundred (300) feet of the high-water line of any reservoir, nor within two hundred (200) feet of the edge, margin, or precipitous bank of any watercourse of the Dolgeville water supply.

15. No decayed or fermented fruit or vegetables, cider-mill waste, roots, grain or vegetable refuse of any kind shall be located, placed, maintained, or allowed to remain in such places that the drainage, leachings or washings therefrom may flow by open, blind, or covered drains or channels of any kind into any reservoir or watercourse of the Dolgeville water supply without first having passed over or through such an extent of soil as to have become properly purified, and in no case shall it be deemed that proper purification has been secured unless the above-mentioned

drainage, leachings, or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than two hundred (200) feet before entering any reservoir, or a distance of not less than one hundred (100) feet before entering any watercourse of the Dolgeville water supply.

Dead Animals, Offal, Manufacturing Wastes, etc.

16. No dead animal, bird, fish or any part thereof, nor any offal, nor any refuse from any slaughter house, nor any decomposable or putrescible refuse or waste matter of any kind shall be thrown, placed in or allowed to pass into any reservoir or watercourse of the Dolgeville water supply without the leachings or drainage from such dead animal, bird, fish, offal, slaughter house refuse, or such decomposable or putrescible matter shall have first percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than three hundred (300) feet before entering any reservoir, and not less than two hundred (200) feet before entering any watercourse of the Dolgeville water supply.

Boating, Fishing, and the Harvesting of Ice

17. The harvesting of ice, skating, boating, fishing from boats, from rafts, from the shore and through the ice are hereby prohibited upon or in any and all of the reservoirs of the Dolgeville water supply.

The board of health of the village of Dolgeville, when necessary to regulate or diminish the number of fish in any of the reservoirs, or when in their opinion such privileges may be extended without endangering the purity of the water supply, are hereby authorized to permit boating or fishing, or both, under explicit regulations and restrictions. Such permit, regulations and restrictions must first be approved in writing by the State Commissioner of Health.

A violation or noncompliance with any of the restrictions or regulations under which such permit for boating or fishing is issued shall be construed as a violation or noncompliance with this section of the rules and regulations.

Penalty

18. In accordance with section 70 of chapter 661 of the Laws of 1893, as amended by chapter 251 of the Laws of 1899, chapter 484 of the Laws of 1904, and chapter 582 of the Laws of 1906, the penalty for each and every violation of, or noncompliance with, any of the above rules and regulations which relate to a permanent source or act of contamination is hereby fixed at two hundred dollars ($200.)

The foregoing rules and regulations for the protection from contamination of the public water supply of the village of Dolgeville, N. Y., were duly made, ordained and established on the 7th day of August, 1907, pursuant to chapter 661 of the Laws of the State of New York for 1893, as finally amended by chapter 582 of the Laws of 1906.

EUGENE H. PORTER,
State Commissioner of Health

ALBANY, N. Y.

These rules and regulations, to be operative and valid, must first be published at least once each week for six consecutive weeks in at least one newspaper in Herkimer county, N. Y., and the affidavit, of the printer, publisher or proprietor of each newspaper in which such publication is made, that the publication was so made, together with a copy of the rules and regulations, must be filed with the county clerk of that county.

The cost of each such publication, affidavit and filing must be paid by the water department of the village of Dolgeville, N. Y.

MECHANICVILLE

Rules and regulations for the protection from contamination of the public water supply of the village of Mechanicville, Saratoga county, N. Y.

Rules and Regulations

The following rules and regulations shall apply to Plum brook and to the impounding and distributing reservoir of the Mechanicville water supply, supplying the public water supply of the village of Mechanicville, Saratoga county, N. Y., and to all water courses entering or ultimately discharging into said streams or bodies of water. The term "reservoir" whenever used in these rules is intended to mean and comprise every natural or artificial reservoir, lake or pond which stores or detains water that enters or may enter the public water supply of the village of Mechanicville. The term "water course" wherever used in these rules is intended to mean and comprise every spring, stream, ditch, gutter or other watercourse of any kind, the waters of which when running, whether constantly or occasionally, eventually flow, or may flow, into the public water supply of the village of Mechanicville.

Privies Adjacent to Reservoirs or Watercourses

1. No privy, privy vault, pit, cesspool, or any other receptacle of any kind used for the temporary storage or deposit of human excreta shall be constructed, placed or maintained with its nearest point within fifty (50) feet, horizontal measurement of the high-water mark of any reservoir, or of the edge, margin or precipitous bank of any watercourse of the Mechanicville supply.

2. No privy, privy vault, pit, cesspool or any other receptacle used for the permanent deposit of human excreta shall be constructed, located, placed or maintained with its nearest point within two hundred (200) feet horizontal measurement of the water line of any reservoir of the Mechanicville water supply, or within one hundred fifty (150) feet, horizontal measurement of the edge, margin or precipitous bank of any watercourse of the Mechanicville water supply.

3. Every privy, privy vault, pit, cesspool or other receptacle or place used for the temporary storage of human excreta which is constructed, located or maintained within the aforesaid two hundred (200) feet, horizontal measurement of the high-water mark of any reservoir, or within the aforesaid one hundred fifty (150) feet, horizontal measurement, of the edge, margin or precipitous bank of any watercourse of the Mechanicville water supply, from which privy or other receptacle the excreta are not at once removed automatically by means of suitable water-tight pipes or conduits to some proper place of ultimate disposal, as hereinafter

provided, shall be arranged in such manner that all such excreta shall be received temporarily in suitable vessels or receptacles which shall at all times be maintained in an absolutely water-tight condition and which will permit of convenient removal to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid receptacles shall be removed and the receptacles thoroughly cleansed and deodorized as often as may be found necessary in order to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundations or floor of the privy. In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid receptacles shall, when removed, be disposed of by burying in trenches, or by thoroughly digging it into the soil in such place and manner as to effectually prevent them from being washed over the surface of the ground by rain or melting snow, and at distances of not less than three hundred (300) feet, horizontal measurement, from the high-water mark of any reservoir, or not less than two hundred (200) feet from the edge, margin, or precipitous bank of any watercourse of the Mechanicville water supply.

6. Whenever it shall be found that owing to the character of the soil or of the surface of the ground, or owing to the height or flow of sub-soil, or surface water, or other special local conditions, the excremental matter, from any privy or aforesaid receptacle, or from any trench or place of disposal may, in the opinion of the State Commissioner of Health be washed over the surface or through the soil into any reservoir or watercourse, then the said privy or receptacle for excreta or the said trench or place of disposal shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Department of Health.

Sewage, House Slops, Sink Waste, Etc.

7. No sewage or excremental matter from any water-closet, privy or cesspool shall be led, conducted or discharged by any pipe, drain or ditch into any reservoir, or watercourse of the Mechanicville water supply, nor shall any such matter be placed, led, discharged or allowed to escape onto the surface of the ground or into the ground below the surface within three hundred (300) feet, horizontal measurement, from the high-water mark of any reservoir, of within two hundred (200) feet, horizontal measurement of the edge, margin or precipitous bank of any watercourse of the Mechanicville water supply.

8. No garbage, putrescible matter, house slops, bath waters, kitchen or sink waste, refuse or waste water from creameries, cheese factories, laundries, nor water in which milk cans, utensils, clothes, bedding, carpets or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse of the Mechanicville water supply. Nor shall any such liquid or solid refuse or waste be thrown or discharged upon the surface of any ground or into the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse of the Mechanicville water supply within one hundred (100) feet, horizontal measurement, of the edge, margin or precipitous bank of any watercourse of the Mechanicville water supply.

9. No clothing, bedding, carpets, harness, vehicle, receptacles, utensils, nor anything that pollutes water shall be washed, rinsed or placed in any reservoir or watercourse of the Mechanicville water supply.

Bathing, Animals, Manure, Compost, etc.

10. No person shall be allowed to bathe in any reservoir or watercourse of the Mechanicville water supply, nor shall any animals or poultry be allowed to stand, wade or swim in said reservoir or watercourse, nor be washed therein.

The watering of live stock or animals in the distributing reservoir of the Mechanicville water supply or in the streams tributary thereto within a distance of five hundred (500) feet from said reservoir is hereby prohibited. Nor shall cattle or live stock be pastured or allowed to graze within twenty-five (25) feet of the high water margin of said reservoir or within twenty-five (25) feet of the banks of said tributary streams at any point within five hundred (500) feet from said reservoir.

11. No stable for cattle or horses, barn-yard, hog-pen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile nor compost heap shall be located, placed, maintained or allowed to remain with its nearest point less than one hundred fifty (150) feet, horizontal measurement, from high-water mark of any reservoir, or less than seventy-five (75) feet, horizontal measurement, from the edge, margin or precipitous bank of any watercourse of the Mechanicville water supply, and none of the above-named objects or sources of pollution shall be so located, placed, maintained or allowed to remain that the drainage, leachings or washings from the same may enter any reservoir or watercourse of the Mechanicville water supply, without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than one hundred and fifty (150) feet before entering any reservoir, nor less than seventy-five (75) feet before entering any watercourse of the Mechanicville water supply.

12. No human excrement or compost containing human excrement shall be placed, piled or spread upon the ground, or dug or buried in the soil within a distance of three hundred (300) feet from the high-water line of any reservoir, nor within a distance of two hundred (200) feet from the edge, margin or precipitous bank of any watercourse of the Mechanicville water supply, and no manure or compost of any kind shall be placed, piled or spread upon the ground, within one hundred and fifty (150) feet of the high water line of any reservoir, nor within seventy-five (75) feet of the edge, margin or precipitous bank of any watercourse of the Mechanicville water supply.

13. No decayed or fermented fruit or vegetables, cider mill waste, roots, grain or other vegetable refuse of any kind shall be located, placed, maintained or allowed to remain in such places that the drainage, leachings or washings therefrom may flow by open, blind or covered drains or channels of any kind into any reservoir or watercourse of the Mechanicville water supply without first having passed over or through such an extent of soil as to have become properly purified, and in no case shall it be deemed that sufficient purification has been secured unless the above-mentioned drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage for a distance of not less than one hundred (100) feet before entering any reservoir, or a distance not less than fifty (50) feet before entering any watercourse of the Mechanicville water supply.

Dead Animals, Offal, Manufacturing Wastes, etc.

14. No dead animal, bird, fish or any part thereof, nor any offal nor any refuse from any slaughter house, nor any decomposable or putrescible refuse or waste matter of any kind shall be thrown, placed in or allowed to pass into any reservoir or watercourse of the Mechanicville water supply without first having percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than one hundred and fifty (150) feet before entering any reservoir, and not less than one hundred (100) feet before entering any watercourse of the Mechanicville water supply.

Boating and Fishing

15. Skating, boating, fishing from boats, from rafts, from the shore, and through the ice are hereby prohibited in any and all of the reservoirs of the Mechanicville water supply.

The board of health of the village of Mechanicville, when necessary to regulate or diminish the number of fish in any of the reservoirs, or when in their opinion such privileges may be extended without endangering the purity of the water supply, are hereby authorized to permit boating or fishing or both, under explicit regulations and restrictions. Such permit, regulations and restrictions must first be approved in writing by the State Commissioner of Health.

A violation or noncompliance with any of the restrictions or regulations under which such permit for boating or fishing is issued shall be construed as a violation or noncompliance with this section of the rules and regulations.

16. No water from the Hudson river shall at any time be pumped into the distributing system or into any reservoir of the Mechanicville water supply.

Penalty

17. In accordance with section seventy of chapter six hundred sixty-one (661) of the Laws of 1893, as amended by chapter two hundred fifty-one (251) of the Laws of 1899, chapter four hundred eighty-four (484) of the Laws of 1904 and chapter five hundred eighty-two (582) of the Laws of 1906, the penalty for each and every violation of, or noncompliance with, any of the above rules and regulations which relate to a permanent source or act of contamination is hereby fixed at two hundred ($200) dollars.

The foregoing rules and regulations for the protection from contamination of the public water supply of the village of Mechanicville, N. Y., were duly made, ordained and established on the 14th day of August, 1907, pursuant to chapter six hundred sixty-one (661) of the Laws of the State of New York for 1893, as finally amended by chapter five hundred eighty-two (582) of the Laws of 1906.

EUGENE H. PORTER,

ALBANY, N. Y. *State Commissioner of Health*

These rules and regulations, to be operative and valid, must first be published at least once each week for six consecutive weeks in at least one newspaper in Saratoga county, N. Y., and the affidavit of the printer, publisher or proprietor of each newspaper in which such publication is made, that the publication was so made, together with a copy of the rules and regulations, must be filed with the county clerk of that county.

The cost of each such publication, affidavit and filing must be paid by the water department of the village of Mechanicville, N. Y.

NEW YORK INTER-URBAN WATER COMPANY

Rules and regulations for the protection from contamination of the public water supply furnished by the New York Inter-Urban Water Company.

Rules and Regulations.

The rules and regulations hereinafter given, duly made and enacted in accordance with the provisions of sections 70, 71 and 72 of the Public Health Law heretofore set forth, shall apply to those portions of the drainage areas of Mamaroneck river, Hutchinson river and Tom Paine brook which form or are tributary to the sources of water supply of the New York Inter-Urban Water Company, of Westchester county, N. Y. They shall also apply to the reservoirs and to the filter basins of the said company.

The term "reservoir" wherever used in these rules is intended to mean and refer to any reservoir or filter basin of the New York Inter-Urban Water Company. The term "watercourse" wherever used in these rules, is intended to mean and include every spring, pond (other than the artificial reservoirs and filter basins), stream, ditch, gutter, or other channel or permeable pipe or conduit of every kind, the water of which when running, whether continuously or occasionally, eventually flow, or may flow, into the water supply of the said New York Inter-Urban Water Company.

Wherever a linear distance of a structure or object from a reservoir or from a watercourse is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the high-water mark of a reservoir, or to the edge, margin or precipitous bank forming the ordinary high-water mark of such watercourse.

Privies Adjacent to any Reservoir or Watercourse

1. No privy, privy vault, pit, cesspool or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed or maintained with its nearest point within fifty (50) feet of any reservoir or watercourse of the water supply of the New York Inter-Urban Water Company.

2. No privy, privy vault, pit, cesspool or any other receptacle used for the permanent deposit of human excreta, shall be constructed, located, placed or maintained with its nearest point within one hundred and fifty (150) feet of any reservoir or watercourse of the water supply of the New York Inter-Urban Water Company.

3. Every privy, privy vault, pit, cesspool or other receptacle or place used for the temporary storage of human excreta which is constructed, located or maintained within the aforesaid one hundred and fifty (150) feet, horizontal measurement, of the water line of any reservoir or the edge, margin or precipitous bank of any watercourse of the water supply of the New York Inter-Urban Water Company from which privy, or other receptacle the excreta are not at once removed automatically by means of suitable water-tight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided, shall be arranged in such manner that all such excreta shall be received temporarily in suitable vessels or receptacles which shall at all times be maintained in an absolutely water-tight condition and which will permit of convenient removal to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid receptacles, shall be removed and the receptacles thoroughly cleaned and deodorized as often as may be found necessary, in order to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundations or floor of the privy. In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thoroughly covered and

that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid receptacles shall, when removed, be disposed of by burying in trenches, or by thoroughly digging it into the soil in such place and manner as to effectually prevent them being washed over the surface of the ground by rain or melting snow, and at distances not less than three hundred (300) feet, horizontal measurement, from the high-water mark of any reservoir, or not less than two hundred (200) feet from the edge, margin, or precipitous bank of any watercourse of the New York Inter-Urban water supply.

6. Whenever it shall be found that owing to the character of the soil or of the surface of the ground, or owing to the height or flow of sub-soil or surface water, or other special local conditions, the excremental matter from any privy or aforesaid receptacle, or from any trench or place of disposal, or the garbage or wastes from any dump, may, in the opinion of the State Commissioner of Health, be washed over the surface, or through the soil into any reservoir or watercourse, then the said privy or receptacle for excreta or the said trench or place of disposal or the said garbage or waste dump, shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage, House Slops, Sink Waste, etc.

7. No sewage nor excremental matter from any water-closet, privy, or cesspool shall be led, conducted, or discharged by any pipe, drain or ditch into any reservoir or watercourse of the water supply of the New York Inter-Urban Water Company, nor shall any such matters be placed, led, discharged or allowed to escape onto the surface of the ground or into the ground below the surface within two hundred (200) feet of any such reservoir or watercourse.

8. No garbage, putrescible matter, house slops, bath water, kitchen or sink waste, refuse or waste water, from creameries,

cheese factories, laundries, nor water in which milk cans, utensils, clothing, bedding, carpets or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind, shall be thrown or discharged directly or indirectly into any reservoir or watercourse of the water supply of the New York Inter-Urban Water Company; nor shall any such liquid or solid refuse or waste be thrown or discharged upon the surface of the ground or into the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse of the water supply of the New York Inter-Urban Water Company, within one hundred (100) feet of any such reservoir or within seventy-five (75) feet of any such watercourse.

9. No clothing, bedding, carpets, harness, vehicle, receptacles, utensils, nor anything that pollutes water, shall be washed, rinsed or placed in any reservoir or watercourse of the water supply of the New York Inter-Urban Water Company.

Bathing, Animals, Manure, Compost, etc.

10. No person shall be allowed to bathe in any reservoir or watercourse of the water supply of the New York Inter-Urban Water Company, nor shall any animals or poultry be allowed to stand, wade or swim in said reservoir or watercourse, nor be washed therein.

11. No stable for cattle or horses, barnyard, hog yard, pig pen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap, shall be located, placed, maintained or allowed to remain with its nearest point less than one hundred and fifty (150) feet from any reservoir, or seventy-five (75) feet from any watercourse of the water supply of the New York Inter-Urban Water Company; and none of the above-named objects or sources of pollution shall be so located, placed, maintained or allowed to remain that the drainings, leachings or washings from the same may enter any such reservoir or watercourse without first having been passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainage, leachings or washings

shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for the distance of not less than one hundred and fifty (150) feet before entering any such reservoir, nor less than seventy-five (75) feet before entering any such watercourse.

12. No human excrement or compost containing human excrement shall be placed, piled or spread upon the ground, or dug or buried in the soil, within a distance of three hundred (300) feet from any reservoir, or two hundred (200) feet from any watercourse of the water supply of the New York Inter-Urban Water Company; and no manure or compost of any kind shall be placed, piled or spread upon the ground within one hundred and fifty (150) feet of any such reservoir, or seventy-five (75) feet of any such watercourse.

13. No decayed or fermented fruit or vegetables, cider [illegible] waste, roots, grain or other vegetable refuse of any kind shall located, placed, maintained or allowed to remain in such place that the drainage, leachings or washings therefrom may flow open, blind or covered drains or channels of any kind into any reservoir or watercourse of the water supply of the New York Inter-Urban Water Company, without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that sufficient purification has been secured unless the above-mentioned drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than one hundred (100) feet before entering any such reservoir or fifty (50) feet before entering any such watercourse.

Dead Animals, Offal, Manufacturing Waste, etc.

14. No dead animal, bird, fish, or any part thereof, nor any offal or waste matter of any kind, shall be thrown, placed in, or allowed to pass into any reservoir or watercourse of the water supply of the New York Inter-Urban Water Company; nor shall any such material or refuse be so located, placed, maintained or allowed to remain that the drainage, leachings, or washings therefrom may reach any such reservoir or watercourse without hav-

ing first percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than one hundred and fifty (150) feet before entering any such reservoir, or one hundred (100) feet before entering any such watercourse.

Fishing and Boating

15. No fish shall be taken from any reservoir, nor shall any person fish in any reservoir or through the ice upon the same, nor trespass upon the waters of any reservoir or the ice thereon, nor maintain or use any boat or boats thereon except the officials or duly authorized employees of the New York Inter-Urban Water Company in the exercise of their duties in the management and operation of the reservoirs.

Inspection

16. The New York Inter-Urban Water Company, through its superintendent or other duly authorized official, shall maintain systematic and thorough inspection of the reservoirs, streams and of the entire drainage area tributary thereto, for the purpose of determining whether the above rules are being complied with. At least four such inspections shall be made each year, and such others as may be directed by the State Commissioner of Health. A full and detailed report of each such inspection, including a statement of each violation or noncompliance with the rules, shall be submitted in writing to the State Commissioner of Health within ten days of the completion of such inspection.

Penalty

17. In accordance with section 70 of chapter 661 of the Laws of 1893, as finally amended by chapter 582 of the Laws of 1906, the penalty for each and every violation of, or noncompliance with, any of these rules and regulations which relate to a permanent source or act of contamination, is hereby fixed at one hundred ($100) dollars.

The foregoing rules and regulations for the protection from contamination of the public water supply of the New York Inter-Urban Water Company of Westchester county, N. Y., were duly made, ordained and established on the 16th day of September 1907, pursuant to chapter 661 of the Laws of the State of Ne York for 1893, as finally amended by chapter 582 of the Law of 1896.

EUGENE H. PORTER,
State Commissioner of Health

ALBANY, N. Y.

SARANAC LAKE

The following amendment to the rules protecting the wat supply of the village of Saranac Lake was enacted on Apr 25, 1907.

The full set of rules as enacted may be found in the Twenty-seventh Annual Report.

Rules and Regulations for the Protection from Contamination of the Public Water Supply of the Village of Saranac Lake

The rules and regulations heretofore adopted under the provisions of sections 70, 71 and 72 of the Public Health Law, which apply to the entire drainage area of McKenzie lake or pond, situated in the township of St. Armand and North Elba, Essex county, N. Y., which forms the source of the public water supply of the village of Saranac Lake, N. Y., are hereby amended as follows:

Rule 13. No person or persons shall erect, maintain, use or occupy any tent, camp, cottage or other structure on any State land within a distance of three hundred feet (300) from the shore of the said lake or any watercourse *flowing into it; and no person or persons, except representatives of the sewer and water board or board of health for some necessary purpose in connection with the said water supply, shall, when the said lake is frozen, enter upon the ice thereon or travel over the same either on foot or otherwise.*

The penalty fixed in the original rules and regulations, adopted February 14, 1906, apply to the above rule and the said rule and regulation for the protection from contamination of the public water supply of the village of Saranac Lake, N. Y., is hereby duly made, ordained and established on this 25th day of April, 1907, pursuant to chapter 661, Laws of the State of New York, for 1893, as amended by chapter 484, Laws of 1904, and chapter 582, Laws of 1906. It is in all respects ordained and established as a part of said original rules.

EUGENE H. PORTER,
State Commissioner of Health

SYRACUSE

Rules and regulations for the protection from contamination of the public water supply of the city of Syracuse, N. Y.

General Regulations

The rules and regulations hereinafter given, duly made in accordance with the provisions of sections 70, 71 and 72 of the Public Health Law, heretofore set forth, shall apply to the entire drainage area of Skaneateles lake, which forms the source of public water supply of the city of Syracuse, N. Y.

The term "lake" wherever used in these rules is intended to mean Skaneateles lake. The term "watercourse" wherever used in these rules is intended to mean and include every spring, pond, or lake (other than Skaneateles lake) and every stream having a well defined course or flow at all seasons of the year, which flows or drains into Skaneateles lake. In order to give a definite meaning or limitation to the character of the streams thus described, the term "watercourse" shall include any of the streams indicated in their proper conventional signs, upon the following topographical sheets of the United States Geological Survey of New York; the Skaneateles quadrangle of the edition of January 1902; the Moravia quadrangle of the edition of March, 1902; the Tully qaudrangle of the edition of January, 1900, and the Cortland qaudrangle of the edition of May, 1903.

For the purpose of graduating the severity of these rules, in their application to different parts of the watershed according to the relative danger arising from the different classes of polluting materials and the remoteness from the intake of Skaneateles water supply, the lake and its drainage area are divided into three districts and three zones, as follows:

"District A" shall include the portion of the lake and the watershed tributary to the lake, and the streams entering it, northerly of a line perpendicular to the axis of the lake and through the Five Mile Point.

"District B" shall include the portion of the lake and the watershed tributary to the lake and the streams entering it, between the line through Five Mile Point above described and the corresponding line through Ten Mile Point.

"District C" shall include the portion of the lake and the watershed tributary to the lake and the streams entering it southerly of the line through Ten Mile Point.

"Zone I" shall include the water of the lake and all of the area tributary thereto within a distance of fifty feet of the high-water mark of the lake and all watercourses in District A; within thirty feet of such high-water mark and watercourses in District B; and within ten feet of such high-water mark and watercourses in District C.

"Zone II" shall include the area between the outside limits of Zone I and lines parallel thereto and 150 feet therefrom in District A; 100 feet therefrom in District B; and fifty feet therefrom in District C.

"Zone III" shall include the remaining area of the watershed tributary to Owasco lake beyond the outside limits of Zone II.

RULES AND REGULATIONS

Privies Adjacent to the Lake and to Watercourses

1. No privy, privy vault, pit, cesspool or any other receptacle of any kind or place used for the temporary or permanent storage of human excreta shall be constructed, placed, maintained or allowed to remain within the area included in Zone I.

2. No privy, privy vault, pit, cesspool or any other receptacle of any kind or place for the permanent deposit of human excreta

shall be constructed, placed, maintained, or allowed to remain within the area included in Zone II.

3. Every privy, privy vault, pit, cesspool or other receptacle of any kind or place used for the temporary storage of human excreta which is constructed, placed, maintained or allowed to remain within the limiting distance prescribed and stated by rule (2) from which privy or other receptacle the excreta are not at once removed automatically through suitable water-tight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided, shall be arranged in such manner that all such excreta shall be received temporarily in suitable movable receptacles which shall at all times be maintained in an absolutely water-tight condition and which will permit of convenient removal to some suitable place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid permissible temporary receptacles shall be removed and the receptacles thoroughly cleansed and deodorized as often as may be found necessary to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundations of floor of the privy. In affecting this removal the utmost care shall be exercised that none of the contents be allowed to escape in being transferred from the privy to the place of disposal hereinafter specified and that the contents, while being transferred from the privy to the place of disposal shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to the occupants of the premises and of adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid receptacles shall, when removed, be disposed of by burying in trenches, or by thoroughly digging it into the soil in such place and manner as to effectually prevent them being washed over the surface of the ground by rain or melting snow, and at distances not less than 1,000 feet in District A, 700 feet in District B and 400 feet in District C from the waters of the lake or of the watercourses tributary thereto.

6. Whenever it shall be found that, owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or owing to other special local

conditions, the excremental matter from any privy or aforesaid receptacle, or from any trench or place of disposal may, in the opinion of the State Commissioner of Health, be washed over the surface or through the soil in an imperfectly purified condition into the lake or any watercourse, then the said privy or receptacle for excrementa, or the said trench or place of disposal shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage, House Slops, Sink Waste, etc.

7. No house slops, bath water, sewage or excremental matter from any watercloset, privy, or cesspool, shall be thrown, placed, led, conducted, or discharged or allowed to escape or flow from any pipe, drain or ditch, either directly or indirectly, into the lake or into any watercourse, nor shall any such matter be thrown, placed, led, conducted, or discharged or allowed to escape or flow onto the surface of the ground or into the ground below the surface within the area included in Zones I and II.

8. No garbage, putrescible matter, kitchen or sink waste, refuse or waste matter from any creamery, cheese factory, laundry, nor water in which milk cans, utensils, clothes, bedding, carpets or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind, shall be thrown or discharged directly or indirectly into the lake or any watercourse; nor shall any such liquid or solid refuse or waste matter be thrown, discharged, or allowed to escape or remain upon the surface of the ground or to percolate into or through the ground below the surface in any manner whereby the same may flow into the lake or into any watercourse within the area included in Zones I and II.

9. No clothing, bedding, carpets, harness, vehicle, receptacle, utensil, nor anything that in any way or to any degree pollutes water shall be washed, rinsed or placed in the lake or in any watercourse tributary thereto.

Bathing, Animals, Manure, Compost, etc.

10. No person shall be allowed to bathe in the waters of Skaneateles lake nor shall any animals or poultry be allowed to stand,

wade, swim or be washed in said lake or any watercourses tributary thereto.

11. No stable for cattle or horses, barnyard, hog-pen, poultry house or yard, hitching post or standing place for horses or other animals, manure pile nor compost heap shall be constructed, placed, maintained or allowed to remain within the area included in Zone I; and none of the above named objects or sources of pollution shall be constructed, placed, maintained or allowed to remain where, or in such manner that the drainings, leachings, or washings, therefrom may enter the lake or any watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage.

12. No human excreta or compost containing the same shall be thrown, placed, discharged or allowed to escape or to pass into the lake or any watercourse, nor to be placed, piled or spread upon the ground, or buried or dug into the soil, within a distance of 1,000 feet in District A, 700 feet in District B and 400 feet in District C from the waters of the lake or watercourses tributary thereto; and no manure or compost of any kind shall be thrown, placed, discharged or allowed to escape or to pass into the lake or any watercourse, nor be placed, piled or spread upon the ground, or buried or dug into the soil, within the area included in Zones I and II.

13. No decayed or fermented fruit or vegetables, cider mill waste, roots, grain or other vegetable refuse of any kind shall be thrown, placed, discharged or allowed to escape or to pass into the lake or any watercourse, nor shall they be thrown, placed, piled, maintained or allowed to remain within the area included in Zone I, or in such places that the drainage, leachings or washings therefrom may flow by open, blind or covered drains or channels of any kind into the lake or any watercourse, nor may any such material or the drainage, leachings or washings therefrom percolate through the ground to the lake or any watercourse, without first having passed over or through such an extent of soil as to have become properly purified, and in no case shall it be

deemed that sufficient purification has been secured unless the above mentioned leachings, drainage or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage.

Dead Animals, Offal, Manufacturing Waste, Etc.

14. No dead animal, bird, fish, nor any part thereof, nor any offal nor refuse from any slaughter-house, nor any decomposable or putrescible animal refuse or waste matter of any kind shall be thrown, placed, discharged or allowed to escape or to pass into the lake or any watercourse, nor shall any such material or refuse be so thrown, placed, piled, maintained or allowed to remain in the area included in Zone I or in such places that the drainage, leachings or washings therefrom may reach the lake or any watercourse without first having percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage.

Refuse from Boats

15. No excreta, garbage, slops nor any decomposable or putrescible matter of any kind shall be thrown, discharged or allowed to escape or to pass into the lake from any steamer, barge, launch, sailboat or rowboat. Steamers, barges, and other boats having watercloset or toilet accommodations shall be provided with removable water-tight receptacles, which shall be regularly emptied, cleaned and deodorized at least once each day, under the same restrictions as those which are imposed by rules 4, 5 and 6.

16. No excreta, garbage, slop, or any decomposable or putrescible matter of any kind shall be conveyed or transported in any manner in or upon any steamer, barge, launch, sailboat or rowboat upon the waters of the lake except as otherwise provided under section 15. No empty receptacles in which excreta, garbage, slop, or any decomposable or putrescible material shall have been temporarily or otherwise stored, shall be conveyed or transported upon the waters of the lake without express permission from the State Commissioner of Health. The transportation of any such empty receptacles shall be performed in vessels of special water-tight construction, the design and construction of which shall first be approved by the State Commissioner of Health. In pass-

ing up and down the lake, such vessels shall always follow a course close to the shores of the lake and as far as possible from the intake of the water supply.

Inspection

17. The water department of the city of Syracuse through a duly appointed agent, shall maintain a regular systematic and continual inspection of the lake, of boats used on or navigating the same, of the lake shores, of buildings located thereon, and of the entire drainage area of the lake for the purpose of determining whether the above mentioned rules are complied with. A full and detailed report of the results of such inspections shall be submitted to the State Commissioner of Health on or about the 1st day of the months of May, August, November, February, and a duplicate copy of each report shall be furnished the board of health of the city of Syracuse.

Penalty

18. In accordance with section 70 of chapter 661 of the Laws of 1893, as finally amended by chapter 582 of the Laws of 1906, the penalty for each and every violation of, or non-compliance with, any of the above rules and regulations which relate to a permanent source or act of contamination is hereby fixed at one hundred dollars ($100).

The foregoing rules and regulations for the protection from contamination of the public water supply of the city of Syracuse, N. Y., were duly made, ordained and established on the 25th day of November, 1907, pursuant to chapter 661 of the Laws of the State of New York for 1893, as finally amended by chapter 582 of the Laws of 1906.

EUGENE H. PORTER,
State Commissioner of Health

ALBANY, N. Y.

These rules and regulations, to be operative and valid, must first be published at least once each week for six consecutive weeks in at least one newspaper in Onondaga, Cayuga and Cortland counties, N. Y., and in each county the affidavit of the printer, publisher or proprietor of each newspaper in which such publication is made, that the publication was so made, together with a copy of the rules and regulations, must be filed with the county clerk of that county.

The cost of each such publication, affidavit and cost of filing must be paid by the water department of the city of Syracuse, N. Y.

TROY

Rules and regulations for the protection from contamination of the public water supply of the city of Troy, N. Y.

Rules and Regulations

The rules and regulations hereinafter given duly made and enacted in accordance with the provisions of sections 70, 71 and 72 of the Public Health Law heretofore set forth, shall apply to those portions of the drainage areas of the Tomhannock creek, Sun Kauwissia creek, Deep Kill, Quaken Kill and all other streams which form or are tributary to the sources of water supply of the city of Troy, Rensselaer county, N. Y., and to the Tomhannock reservoir, Newcomb pond, Babcock pond, Quaken Kill, Diverting Dam reservoir, Long pond, Second pond, Mill pond, Shaver pond and White Lily pond and to all other lakes, ponds or reservoirs whose waters form or are tributary to the sources of water supply of the city of Troy, N. Y.

The term "reservoir" whenever used in these rules is intended to mean and refer to any natural or artificial reservoir, lake or pond which stores or detains water that enters or may enter the public water supply of the city of Troy. The term "watercourse" wherever used in these rules is intended to mean and refer to any spring, stream, ditch, gutter or other watercourse of any kind, the waters of which when running, whether constantly or occasionally, eventually flow or may flow into the public water supply of the city of Troy.

Wherever a linear distance of a structure or object from a reservoir or from a water course is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the high-water mark of a reservoir, or to the edge, margin or precipitous bank forming the ordinary high-water mark of such watercourse.

Privies adjacent to any Reservoirs or Watercourse

1. No privy, privy vault, pit, cesspool or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed or maintained with its nearest point within fifty feet of any reservoir or watercourse of the public water supply of the city of Troy.

2. No privy, privy vault, pit, cesspool or any other receptacle used for the permanent deposit of human excreta shall be constructed, located, placed or maintained with its nearest point within 150 feet of any reservoir or watercourse of the public water supply of the city of Troy.

3. Every privy, privy vault, pit, cesspool or other receptacle or place used for the temporary storage of human excreta which is constructed, located or maintained within the aforesaid 150 feet horizontal measurement of the water line of any reservoir or the edge, margin or precipitous bank of any watercourse of the public water supply of the city of Troy, from which privy or other receptacle the excreta are not at once removed automatically by means of suitable water-tight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided, shall be arranged in such manner that all such excreta shall be received temporarily in suitable vessels or receptacles which shall at all times be maintained in an absolutely water-tight condition and which will permit of convenient removal to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid receptacles shall be removed and the receptacles thoroughly cleaned and deodorized as often as may be found necessary in order to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundations or floor of the privy.

In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid receptacles shall, when removed, be disposed of by burying in trenches, or by thoroughly digging it into the soil in such place and manner as to effectually prevent them being washed over the surface of the ground by rain or melting snow, and at distances not less than 300 feet, horizontal measurement, from the high-water mark of any reservoir, or not less than 200 feet from the edge, margin, or precipitous bank of any watercourse of the public water supply of the city of Troy.

6. Whenever it shall be found that owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or other special local conditions, the excremental matter from any privy or aforesaid receptacle or from any trench or place of disposal of the garbage or wastes from any dump, may, in the opinion of the State Commissioner of Health, be washed over the surface or through the soil into any reservoir or watercourse, then the said privy or receptacle for excreta or the said trench or place of disposal or the said garbage or waste dump shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage, House Slops, Sink Waste, Etc.

7. No sewage nor excremental matter from any watercloset, privy, or cesspool shall be led, conducted, or discharged by any pipe, drain or ditch into any reservoir or watercourse of the public water supply of the city of Troy, nor shall any such matters be placed, led, discharged or allowed to escape onto the surface of the ground or into the ground below the surface within 200 feet of any such reservoir or water course.

8. No garbage, putrescible matter, house slops, bath water, kitchen or sink wastes, refuse or waste water from creameries, cheese factories, laundries, nor water in which milk cans, utensils, clothing, bedding, carpets or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse of the public water supply of the city of Troy; nor shall any such liquid or solid refuse or waste be thrown or discharged upon the surface of the ground or into the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse of the public water supply of the city of Troy within 100 feet of any such reservoir or within seventy-five feet of any such watercourse.

9. No clothing, bedding, carpets, harness, vehicle, receptacles, utensils nor anything that pollutes water shall be washed, rinsed or placed in any reservoir or watercourse of the public water supply of the city of Troy.

Bathing, Animals, Manure, Compost, Etc.

10. No person shall be allowed to bathe in any reservoir or watercourse of the public water supply of the city of Troy, nor shall any animals or poultry be allowed to stand, wade or swim in said reservoir or watercourse, nor shall be washed therein.

11. No stable for cattle or horses, barnyard, hog-yard, pigpen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile, compost heap shall be located, placed, maintained or allowed to remain with its nearest point less than 150 feet from any reservoir or seventy-five feet from any watercourse of the public water supply of the city of Troy; and none of the above named objects or sources of pollution shall be so located, placed, maintained or allowed to remain that the drainings, leachings or washings from the same may enter any such reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainage, leachings or washings shall have percolated over or through the soil in a scattered, dis-

sipated form, and not concentrated in perceptible lines of drainage, for the distance of not less than 150 feet before entering any such reservoir, nor less than seventy-five feet before entering any such watercourse.

12. No human excrement or compost containing human excrement shall be placed, piled or spread upon the ground, or dug or buried in the soil, within a distance of 300 feet from any reservoir of 200 feet from any watercourse of the public water supply of the city of Troy; and no manure or compost of any kind shall be placed, piled or spread upon the ground within 150 feet of any such reservoir or seventy-five feet of any such watercourse.

13. No decayed or fermented fruit or vegetables, cider mill waste, roots, grain or other vegetable refuse of any kind shall be located, placed, maintained or allowed to remain in such places that the drainage, leachings, or washings therefrom may flow by open, blind or covered drains or channels of any kind into any reservoir or watercourse of the public water supply of the city of Troy, without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that sufficient purification has been secured unless the above mentioned drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than 100 feet before entering any such reservoir or fifty feet before entering any such watercourse.

Dead Animals, Offal, Manufacturing Waste, Etc.

14. No dead animal, bird, fish, or any part thereof, nor any offal or waste matter of any kind, shall be thrown, placed in, or allowed to pass into any reservoir or watercourse of the public water supply of the city of Troy; nor shall any such material or refuse be so located, placed, maintained or allowed to remain that the drainage, leachings or washings therefrom may reach any such reservoir or watercourse without having first percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than 150 feet before entering any such reservoir or 100 feet before entering any such watercourse.

Fishing and Boating and Ice Cutting

15. No fish shall be taken from any reservoir, nor shall any person fish in any reservoir or through the ice upon the same, nor trespass upon the waters of any reservoir or the ice thereon, nor maintain or use any boat or boats thereon except the officials or duly authorized employes of the public water supply of the city of Troy in the exercise of their duties in the management and operation of the reservoirs.

No person or persons shall cut or remove any ice from any of the reservoirs which form or are tributary to the sources of the public water supply of the city of Troy.

16. No interment of a human body shall be made within fifty feet of any watercourse or within 200 feet of any reservoir of the public water supply of the city of Troy.

17. The bureau of water supply of the city of Troy, through its superintendent or other duly authorized official, shall maintain systematic and thorough inspection of the reservoirs, streams and of the entire drainage area tributary thereto, for the purpose of determining whether the above rules are being complied with. At least six such inspections shall be made each year, and such others as may be directed by the State Commissioner of Health. A full and detailed report of each such inspection, including a statement of each violation or noncompliance with the rules, shall be submitted in writing to the State Commissioner of Health within ten days of the completion of such inspection, and a duplicate copy of each report shall at the same time be furnished to the board of health of the city of Troy.

Penalty

18. In accordance with section 70 of chapter 661 of the Laws of 1893, as finally amended by chapter 582 of the Laws of 1906, the penalty for each and every violation of, or noncompliance with, any of these rules and regulations, which relate to a permanent source or act of contamination, is hereby fixed at one hundred dollars ($100).

The foregoing rules and regulations for the protection from contamination of the public water supply of the city of Troy, Rensselaer county, N. Y., were duly made, ordained and established on the 25th day of November, 1907, pursuant to chapter 661 of the Laws of the State New York of 1893, as finally amended by chapter 582 of the Laws of 1896.

EUGENE H. PORTER,
State Commissioner of Health

ALBANY, N. Y.

These rules and regulations to be operative and valid must first be published at least once each week for six consecutive weeks in at least one newspaper in Resselaer county, N. Y., and the affidavit of the printer, publisher or proprietor of each newspaper in which such publication is made, that the publication was so made, together with a copy of the rules and regulations, must be filed with the county clerk of that county.

The cost of each such publication, affidavit and filing must be paid by the bureau of water supply of the city of Troy, N. Y.

UTICA

Rules and regulations for the protection from contamination of the public water supply of the city of Utica, Oneida county, N. Y.

General Regulations

The rules and regulations hereinafter given, duly made in accordance with sections 70, 71 and 72 of the Public Health Law, shall apply to the entire drainage areas of the streams on the south side of the city, known as Ballou creek and as Starch Factory creek, and to the reservoirs constructed or maintained on those watersheds; to the entire watershed of the stream known as Reel's creek on the north side of the city, with the reservoir or reservoirs constructed or maintained on the watershed of that stream; and to that portion of the watershed of the West Canada creek which lies above the dam at the village of Hinckley, in the town of Russia, including all the tributaries thereof.

The term "watercourse" wherever used in these rules, is intended to mean and include every spring, pond, lake, stream, ditch, gutter or other channel, or permeable pipe, or conduit of every kind, the waters of or from which, when running, whether continuously or intermittently, eventually flow or may flow into one of the several reservoirs from which the public water supply or a portion thereof is or may be taken.

Whenever a linear distance of a structure or object from a watercourse is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the edge, margin or precipitous bank, forming the ordinary normal high-water mark of such watercourse.

Privies Adjacent to Watercourses

1. No privy, privy vault, pit, cesspool, nor any other receptacle of any kind, nor any place used for the temporary storage of human excreta shall be constructed, placed, maintained or allowed to remain within thirty feet of the high-water mark of any pond, reservoir or watercourse of any kind, the water of which, when running, flows eventually into any reservoir of the public water supply of the city of Utica, N. Y.

2. No privy, privy vault, pit, cesspool, nor any other receptacle of any kind, nor any place for the permanent deposit of human excreta shall be constructed, placed, maintained or allowed to remain within 300 feet of the high-water mark of any reservoir, or within 130 feet of any watercourse of any kind, the water of which, when running, flows eventually into any reservoir of the public water supply of the city of Utica, N. Y.

3. Every privy, privy vault, pit, cesspool, or other receptacle of any kind or any place used for the temporary storage of human excreta, which is constructed, placed, maintained, or allowed to remain within the distances named in rules 1 and 2, *i. e.*, between 30 and 130 feet from any watercourse, or between 30 and 300 feet from any reservoir, from which privy or other receptacle the excreta are not at once removed automatically through suitable watertight pipes or conduits, to some proper place of ultimate disposal, as hereinafter provided, shall be pro-

vided with and said excreta shall be received temporarily in suitable movable or permanent receptacles, which shall at all times be maintained in an absolutely watertight condition and not allowed to overflow, and which will permit of the contents being conveniently removed to some suitable place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid permissible temporary or permanent watertight receptacles, shall be removed by duly delegated agents or employees of the water company and the receptacles thoroughly cleansed and deodorized as often as may be found necessary to maintain the privy in a proper sanitary condition, and to effectually prevent any overflows upon the soil or upon the foundation or floors of the privy. In effecting this removal, the utmost care shall be exercised that none of the contents be allowed to escape in being transferred from the privy to the place of disposal, as hereinafter specified, and that the contents while being transferred from the privy to the place of disposal, shall be thoroughly covered, and that the least possible annoyance and inconvenience shall be caused to the occupants of the premises and of adjacent premises.

5. Unless otherwise specifically ordered or permitted in writing by the State Commissioner of Health, the excreta collected in the aforesaid receptacles shall, when removed, be disposed of by burying in trenches, or by thoroughly digging into the soil in such place and manner as to effectually prevent them from being washed over the surface of the ground by rain or melting snow, and at distances of not less than 300 feet from the high water mark of any pond or reservoir, or from any watercourse, the water of which, when running, flows into any reservoir of the public water supply of the city of Utica, N. Y.

6. Whenever it shall be found that, owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or owing to other special local conditions, the excremental matter from any privy or other aforesaid receptacle, or from any trench or place of disposal, may, in the opinion of the State Commissioner of Health, be washed over the surface or through the soil in an imperfectly purified condition into any reservoir or watercourse, then the said privy

or receptacle for excrement or trench or place of disposal shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage, House Slops, Sink Wastes, etc.

7. No house slops, bath water, sewage, or excremental matter from any privy, water closet, or cesspool, shall be thrown, placed, led, conducted or discharged, or allowed to escape, or flow from any pipe, drain or ditch, into any lake or pond or reservoir, or into any watercourse, nor shall any such matter be thrown, placed, led, conducted or discharged, or allowed to escape, or flow onto the surface of the ground or into the ground below the surface, within a distance of 130 feet from the high water mark of any pond or reservoir or of any watercourse which, when running, flows into a reservoir of the public water supply of the city of Utica, N. Y. All liquid wastes of the composition and kind indicated herein, if discharged onto the ground at a point more than 130 feet from the edge of any pond, reservoir, or watercourse as aforesaid, shall pass over or through the ground in a thin film or sheet, not concentrated in any channel or perceptible line of drainage, for a distance of at least 130 feet before being collected in any channel which leads or discharges into any pond, reservoir or watercourse aforesaid.

8. No garbage, putrescible matter, kitchen or sink waste, refuse or waste water from any creamery, cheese factory, laundry, nor water in which milk cans, utensils, clothes, bedding, carpets or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind, shall be thrown or discharged directly or indirectly into any pond or reservoir or watercourse as aforesaid, nor shall any such liquid or solid refuse or waste matter be thrown, discharged or allowed to escape or remain upon the surface of the ground or to percolate into or through the ground below the surface of the ground in a manner whereby the same may flow into the pond, reservoir or watercourse, without having first flowed in a thin film not concentrated in any channel or perceptible line of drainage for a distance of at least fifty feet.

9. No clothing, bedding, carpets, harness, vehicle, receptacle, utensil nor anything that in any way or in any degree pollutes water, shall be placed, washed or rinsed in, nor shall any person bathe in, any pond, reservoir or watercourse which, when running flows into a reservoir of the public water supply of the city of Utica, N. Y.

Animals, Manure, Compost, etc.

10. No stable for cattle or horses, barn yard, hog pen, poultry house or yard, hitching post or standing place for horses or other animals, manure pile or compost heap, shall be constructed, placed, maintained or allowed to remain within a distance of one hundred (100) feet from the edge of any pond or reservoir, or a distance of fifty (50) feet from the edge of a watercourse as aforesaid; and none of the above named objects or sources of pollution shall be constructed, placed, maintained, or allowed to remain where, or in such manner, that the drainage, leachings, or washings therefrom may enter any pond, reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, not concentrated in perceptible lines of drainage, for a distance of at least fifty feet before being discharged into any pond, reservoir or watercourse which when running, flows into a reservoir of the public water supply of the city of Utica, N. Y.

11. No human excreta or compost, containing the same shall be thrown, placed, discharged or allowed to escape, or to pass into any pond, reservoir or watercourse, nor to be placed, piled, or spread upon the ground, or buried or dug into the soil within a distance of 130 feet from the edge of any pond, reservoir or watercourse as aforesaid; and no animal manure or compost of any kind shall be thrown, placed, discharged, or allowed to escape or to pass into any pond, reservoir or watercourse as aforesaid, nor be placed, piled, or spread upon the ground, or buried or dug into the soil, within a distance of fifty feet from the edge of any pond, reservoir, or watercourse as aforesaid; and in no

case shall such placing or spreading of human excreta or of animal manure be permitted on the areas adjacent to any pond, reservoir or watercourse as aforesaid, unless the drainage, leachings or washings from the same shall percolate over or through the soil in a scattered, dissipated form, not concentrated in perceptible lines of drainage, for a distance of at least fifty feet.

12. No decayed or fermented fruit or vegetables, cider mill waste, roots, grain, or other vegetable waste of any kind, shall be thrown, placed, discharged, or allowed to escape or to pass into any pond, reservoir or watercourse as aforesaid, nor shall be thrown, placed, maintained, or allowed to remain in such places that the drainage, leachings or washings therefrom may flow by open, blind or covered drains or channels of any kind into any pond, reservoir or watercourse, nor may any such material or the drainage, leachings or washings therefrom percolate through the ground to any pond, reservoir or watercourse without having first passed over or through such an extent of soil as to have become properly purified, and in no case shall it be deemed that proper purification has been secured unless the above-mentioned drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, not concentrated in perceptible lines of drainage, for a distance of at least fifty feet.

Dead Animals, Offal, Manufacturing Wastes, etc.

13. No dead animal, bird, fish, or any part thereof, nor any offal, nor refuse from any slaughter house, nor any decomposed or putrescible refuse, nor waste matter of any kind shall be thrown, placed, discharged, or allowed to escape, or to pass into, any pond, reservoir or watercourse as afresaid, nor shall any such material or refuse be so placed, maintained, or allowed to remain, that the drainage, leachings or washings therefrom may reach any pond, reservoir or watercourse without first having percolated over or through the soil in a scattered, dissipated form, not concentrated in perceptible lines of drainage, for a distance of at least 200 feet.

14. No interment of a human body shall be made within fifty feet of the highwater mark of any watercourse nor within 200 feet of any pond or reservoir aforesaid.

Inspections

15. The Consolidated Water Company of the city of Utica or such water companies as are supplying water to the city of Utica shall maintain systematic and thorough inspections of the shores of the ponds and reservoirs and of the entire drainage areas of the streams supplying water to the reservoirs from which the water supply of the city of Utica, N. Y., is drawn, for the purpose of determining whether the above-written rules are complied with. At least one such inspection shall be made each month and such others as may be directed by the State Commissioner of Health. A full and detailed report of such inspection shall be submitted in writing to the State Commissioner of Health, and a duplicate copy of each report shall be furnished the health department of the city of Utica, N. Y.

16. It shall be the duty of the officers of the Consolidated Water Company, or of such companies as are supplying or shall supply water to the city of Utica, N. Y., if any such inspection discloses a violation of any foregoing rule or regulation relating to a permanent source or act of contamination, to at once take steps, acting under sections 71 and 72 of chapter 661 of the Laws of 1893, as amended by chapter 484 of the Laws of 1904, to have all violations of these rules discontinued according to the method prescribed in those sections.

17. Any rules, any regulations, or the parts of any rules or regulations previously enacted, inconsistent with these rules and regulations, are hereby repealed.

Penalty

18. In accordance with section 70 of chapter 661 of the Laws of 1893, as amended by chapter 251 of the Laws of 1899, chapter 484 of the Laws of 1904, and chapter 582 of the Laws of 1906, the penalty for each and every violation of, or noncompliance with, any of the above rules and regulations which relate to a permanent source or act of contamination is hereby fixed at $200.

The foregoing rules and regulations for the protection from contamination of the public water supply of the city of Utica,

N. Y., were duly made, ordained, and established on the 5th day of September, 1907, pursuant to chapter 661 of the Laws of the State of New York for 1893, as finally amended by chapter 582 of the Laws of 1906.

EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y.

These rules and regulations, to be operative and valid, must first be published at least once each week for six consecutive weeks, in at least one newspaper in Hamilton, Herkimer and Oneida counties, N. Y., and the affidavit of the printer, publisher or proprietor of each newspaper in which such publication is made, that the publication was so made, together with a copy of the rules and regulations, must be filed with the county clerk of such county.

The cost of each such publication, affidavit and filing must be paid by the Consolidated Water Company of the city of Utica. N. Y.

WEST POINT

Rules and regulations for the protection from contamination of the public water supply of West Point, in the town of Highland, Orange county, N. Y.

Rules and Regulations

The following rules and regulations shall apply to Summit lake, Twin lakes, Bull pond, Popolopen pond, Round pond, Long pond, Cranberry pond, Mine lake and to Popolopen creek and the tributaries supplying the public water supply of West Point, Orange county, N. Y., and to all watercourses entering or discharging into said streams or bodies of water. The term " reservoir " when used in these rules is intended to mean and comprise every natural or artificial reservoir, lake or pond which stores or detains water that enters or may enter the public water supply of West Point, Orange county, N. Y. The term " watercourse " wherever used in these rules is intended to mean and comprise every spring, stream, ditch, gutter or other watercourse of any kind, the waters of which when running, whether constantly or occasionally, eventually flow or may flow into the public water supply of West Point, N. Y.

Privies Adjacent to Reservoirs or Watercourses

1. No privy, privy vault, pit or cesspool, or any other receptacle of any kind used for the temporary storage of human excreta shall be constructed, placed or maintained with its nearest point within fifty feet, horizontal measurement, of the high water mark of any reservoir, or of the edge, margin or precipitous bank of any watercourse of the West Point water supply.

2. No privy, privy vault, pit, cesspool, or any other kind of receptacle used for the permanent deposit of human excreta shall be constructed, located, placed or maintained with its nearest point within 200 feet, horizontal measurement, of the water line of any reservoir of the West Point water supply, or within 150 feet, horizontal measurement, of the edge, margin or precipitous bank of any watercourse of the West Point water supply.

3. No privy, privy vault, pit, cesspool, or any other kind of receptacle used for the permanent deposit of human excreta shall be constructed, located, placed or maintained, within any mine or mine shaft, the drainage from which either by gravity or pumping, flows directly or indirectly into any reservoir or watercourse of the West Point water supply.

4. Every privy, privy vault, pit, cesspool, or other receptacle or place used for the temporary storage of human excreta which is constructed, located, or maintained within the aforesaid 200 feet, horizontal measurement, or of the high water mark of any reservoir, or within the aforesaid 150 feet, horizontal measurement, of the edge, margin or precipitous bank of any watercourse of the West Point water supply, from which privy or other receptacle the excreta are not at once removed automatically by means of suitable water-tight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided, shall be arranged in such manner that all such excreta shall be received temporarily in suitable vessels or receptacles which shall at all

times be maintained in an absolutely water-tight condition and which will permit of convenient removal to some place of ultimate disposal, as hereinafter set forth.

5. Every privy, privy vault, pit, cesspool, or other receptacle or place used for the temporary storage of human excreta which is constructed, located or maintained within any mine or mine shaft, from which privy or receptacle the excreta are not at once removed automatically by means of suitable water-tight pipes or conduits to some proper place of ultimate disposal as hereinafter provided, shall be arranged in such manner that all such excreta shall be received temporarily in suitable vessels or receptacles which shall at all times be maintained in an absolutely water-tight condition and which will permit of convenient removal to some place of ultimate disposal as hereinafter set forth.

6. The excreta collected in the aforesaid receptacles shall be removed and the receptacles thoroughly cleansed and deodorized as often as may be found necessary in order to maintain the privy in proper sanitary condition and to effectually prevent any overflow upon the soil or upon the foundations or floor of the privy. In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal, hereinafter specified, and that the contents while being transferred from the privy to the place of disposal shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

7. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid receptacles shall, when removed, be disposed of by burying in trenches or by thoroughly digging it into the soil in such places and manner as to effectually prevent them being washed over the surface of the ground by rain or melting snow, and at distances not less than 300 feet, horizontal measurement, from the high water mark of any reservoir, or not less than 200 feet from the edge, margin or precipitous bank of any water course of the West Point water supply.

8. Whenever it shall be found that owing to the character of the soil or of the surface of the ground, or owing to the height

or flow of the subsoil, or surface water, or other special local conditions the excremental matter from any privy or other aforesaid receptacle, or from any trench or place of disposal may, in the opinion of the State Commissioner of Health, be washed over the surface or through the soil into any reservoir or watercourse, then the said privy or receptacle for excreta or the said trench or place of disposal shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Department of Health.

Sewage, House Slops, Sink Waste, etc.

9. No sewage or excremental matter from any water closet, privy or cesspool shall be led, conducted, or discharged by any pipe, drain or ditch into any reservoir or watercourse of the West Point water supply, nor shall any such matter be placed, led, discharged or allowed to escape onto the surface of the ground or into the ground below the surface within 300 feet, horizontal measurement, from the high water mark of any reservoir, or within 200 feet, horizontal measurement, of the edge, margin or precipitous bank of any watercourse of the West Point water supply.

10. No garbage, putrescible matter, house slops, bath waters, kitchen or sink waste, refuse or waste water from creameries, cheese factories, laundries, nor waters in which milk cans, utensils, clothes, bedding, carpets, or harnesses have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse of the West Point water suppply. Nor shall any such liquid or solid refuse or waste be thrown or discharged upon the surface of any ground or into the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse of the West Point water supply within 100 feet, horizontal measurement, of the edge, margin or precipitous bank of any watercourse of the West Point water supply.

11. No clothing, bedding, carpets, harness, vehicle, receptacles, utensils, nor anything that pollutes water shall be washed, rinsed, or placed in any reservoir or watercourse of the West Point water supply.

Bathing, Animals, Manure, Compost, etc.

12. No person shall be allowed to bathe in any reservoir or watercourse of the West Point water supply, nor shall any animals or poultry be allowed to stand, wade or swim in said reservoir or watercourse, nor be washed therein.

13. No stable for cattle or horses, barn yard, hog pen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap shall be located, placed, maintained or allowed to remain with its nearest point less than 150 feet, horizontal measurement, from the high water mark of any reservoir, or less than seventy-five feet, horizontal measurement, from the edge, margin or precipitous bank of any watercourse of the West Point water supply, and none of the above-named objects or sources of pollution shall be so located, placed, maintained or allowed to remain that the drainage, leachings or washings from the same may enter any reservoir or watercourse of the West Point water supply without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than 150 feet, before entering any reservoir, nor less than seventy-five feet before entering any watercourse of the West Point water supply.

14. No human excrement nor compost containing human excrement shall be placed, piled or spread upon the ground or dug or buried in the soil within a distance of 300 feet from the high water line of any reservoir; nor within a distance of 200 feet from the edge, margin or precipitous bank of any watercourse of the West Point water supply, and no manure or compost of any kind shall be placed, piled or spread upon the ground within 150 feet of the high water line of any reservoir, nor within 75 feet of the edge, margin or precipitous bank of any watercourse of the West Point water supply.

15. No decayed or fermented fruit or vegetables, cider mill waste, roots, grain, or other vegetable refuse of any kind, shall be located, placed, maintained or allowed to remain in such places

that the drainage, leachings, or washings therefrom may flow by open, blind or covered drains or channels of any kind into any reservoir or watercourse of the West Point water supply, without first having passed over or through such an extent of soil as to have become properly purified, and in no case shall it be deemed that proper purification has been secured unless the above-mentioned drainage, leachings or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than 100 feet before entering any reservoir, or a distance of not less than fifty feet before entering any watercourse of the West Point water supply.

Dead Animals, Offal, Manufacturing Wastes, Etc.

16. No dead animal, bird, nor any part thereof, nor any offal nor any refuse from any slaughter-house, nor any decomposable or putrescible refuse or waste matter of any kind shall be thrown, placed in or allowed to pass into any reservoir or watercourse of the West Point water supply, nor shall any such material or refuse be so located, placed, maintained or allowed to remain that the drainage, leachings or washings therefrom may reach any reservoir or watercourse of the West Point water supply without first having percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than 150 feet before entering any reservoir, and not less than 100 feet before entering any watercourse of the West Point water supply.

Boating and Fishing

17. Skating, boating, fishing from boats, from rafts from the shore and through the ice, are hereby prohibited in any and all of the reservoirs of the West Point water supply.

The department owning or having charge of the water supply of West Point, when necessary to regulate or diminish the number of fish in any of the reservoirs, or when in their opinion such privileges may be extended without endangering the purity of the water supply, are hereby authorized to permit boating or fishing or both under explicit regulations and restrictions. Such permit, regulations and restrictions must first be approved in writing by the State Commissioner of Health.

A violation or noncompliance with any of the restrictions or egulations under which such permit for boating or fishing is ssued shall be construed as a violation or noncompliance with his section of the rules and regulations.

Penalty

18. In accordance with section 70 of chapter 661 of the Laws f 1893, as amended by chapter 251 of the Laws of 1899, chapter 84 of the Laws of 1904 and chapter 582 of the Laws of 1906, he penalty for each and every violation of, or noncompliance rith any of the above rules and regulations which relate to a ermanent source or act of contamination is hereby fixed at $200.

The foregoing rules and regulations for the protection from ontamination of the public water supply of West Point, Orange ounty, N. Y., were duly made, ordained and established on the 5th day of September, 1907, pursuant to chapter 661 of the Laws of the State of New York for 1893, as finally amended by chapter 582 of the Laws of 1906.

EUGENE H. PORTER,
State Commissioner of Health

ALBANY, N. Y.

INSPECTIONS OF VIOLATIONS OF RULES FOR T PROTECTION OF WATER SUPPLIES

During the year inspections were made and orders to loc boards of health issued with respect to violations of the rules an regulations for the protection of the water supplies of the following municipalities, correspondence being presented herewith:

AUBURN

During the year thirty-one cases of violations of rules protecting the Auburn water supply by prohibiting contamination of Owasco lake, have been examined and verified, and orders to local boards of health issued in accordance with section 71 of the Public Health Law requiring them to convene and enforce obedience to the rule or regulation violated.

As an example of what may be accomplished in the matter of water supply protection by thorough inspection of a watershed, the following letter is presented.

AUBURN, N. Y. *April* 22, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

MY DEAR SIR:— In compliance with rule 15 of the rules and regulations for the protection from contamination of the public water supply of the city of Auburn, N. Y., the undersigned water commissioners composing the water board of said city, beg to submit a detailed report of inspections made since the promulgation and subsequent publication of said rules on May 17, 1906.

As a result of this work, 214 cottages or homes (not including Moravia and Locke) were visited and inspected several times. Of this number 102 places were found to be violations and were therefore properly served to abate their then existing conditions. Of this latter number seventy-five have complied with the just requirements of the law. The remaining twenty-seven have either refused or failed to do so, and their names and location have been named to your office to be dealt with according to law.

Very truly yours,

M. P. Conway, M.D.,
W. J. Henry,
F. A. Benson,
Water Commissioners

AVON, LIVONIA AND GENESEO

As one of the results of the sanitary inspection of the Genesee river watershed, an order was issued on November 27, 1907, under section 71 of the Public Health Law. This order required that an inspection be made to determine if any violations existed of the rules and regulations protecting the water supply of the villages of Avon, Livonia and Geneseo, derived from Conesus lake.

HUDSON

Hudson, N. Y., *October* 24, 1907.

Dr. Eugene H. Porter, *State Commissioner of Health, Albany, N. Y.:*

Dear Sir:— The second inspection of the Taghkanic creek watershed was completed October 15, 1907, and a report is hereby submitted of the existing conditions, the changes made and prospective changes:

A fact which will not appear in the notes, and which is worthy of mention, is in the interest shown in the welfare and good health of the residents of this city, by owners of property on the Taghkanic creek watershed. In discussing possible changes with the owners of property on this watershed, in every case, with the exception of one, did we have sympathetic consideration. The spirit shown is indicative of a continuous patrol of the creeks of this region which in turn insures the general health of the city and I am sure is appreciated by its residents.

ROBERT J. HARDING,
Superintendent of Public Works

ALBANY, N. Y., *October* 28, 1907.

R. J. HARDING, *Superintedent of Public Works, Hudson, N. Y.*

DEAR SIR:— I beg to acknowledge receipt of your report of October 24 covering the results of your inspection of the watershed of your water supply and your efforts in removing violations of water rules, together with a copy of your water supply rules.

I am very pleased to note the success of your efforts in remedying conditions upon the watershed of your supply and to learn of the interest and general co-operation of property owners in the matter. In the few cases where insanitary conditions were not corrected to the extent desired, you will no doubt be able to improve through amicable means of adjustment with the property owners. In the remaining cases where a spirit of defiance is met with, it will, of course, be necessary to resort to the enforcement of the water rules according to the Public Health Law.

I would suggest, then, that after exhaustive persuasion and amicable means in the more obdurate cases, you serve the requisite notices upon the offending parties in accordance with section 71 of the Public Health Law, and that in serving these notices you follow explicitly the procedure laid down in said section. Upon the failure of any person thus notified to immediately comply with the rule or regulation violated, it will then be your duty to notify the Department, whereupon orders will be issued by me to the local board of health for the enforcement and obedience to such rules.

I shall await the further advice from you in regard to any persistent violators of your water rules, and can assure you of my desire and intention to assist you in enforcing obedience to these rules.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

SYRACUSE

During the season of 1907 notices were sent from the Department to several property owners on the watershed draining into Skaneateles lake from which the Syracuse water supply is derived, notifying them of their violation of section 75 or section 77 of the Public Health Law.

NEW YORK CITY

During the year 120 violations of the rules and regulations protecting the Croton water supply of New York city were examined into by the engineers and inspectors of the Department and made the subject of orders issued by the Commission to local boards of health. These orders, in accordance with section 71 of the Public Health Law, directed the board of health having jurisdiction in each case to convene and enforce obedience to the rule or regulation violated.

INVESTIGATION OF COMPLAINTS
RELATING TO
STREAM POLLUTION

INVESTIGATION OF COMPLAINTS RELATING TO STREAM POLLUTION

AKRON

ALBANY, N. Y., *June* 15, 1907.

Dr. E. H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— In the matter of the Hamburg Canning Factory nuisance, referred to me on May 15th, by Mr. Horton, I have the honor to report as follows:

On Wednesday, June 12th, I visited the main office at Hamburg and was informed by the secretary that, according to their own suggestion and with my approval, they have just completed two large cesspools or sedimentation tanks to receive the vegetable wastes from the factory. It is expected that the solids will be retained by these tanks and that the latter will discharge only liquid matters, not subject to deposit. This remedy for the nuisance heretofore existing is experimental and cannot be tested until the factory begins operations, about July 1st. At that time, subject to your approval, I will inspect the plant at Akron and be able to report to you as to the efficiency of the deposit tanks.

I suggest that Mr. L. D. Lester be informed of the construction of these tanks and of the continued interest of the Department in the abatement of the nuisance.

Very respectfully,

HENRY N. OGDEN

Assistant Sanitary Engineer

ALDEN

In the 27th annual report, correspondence may be found which relates to complaints of the pollution of Tannery creek in the village of Alden. In July, 1907, further complaints were received, and the report of an investigation follows:

ALBANY, N. Y., *July* 29, 1907.

EUGENE H. PORTER, M. D., *State Commissioner of Health*,
Albany, N. Y.:

DEAR SIR:— In accordance with your directions, I visited on July 25, the village of Alden, Erie county, N. Y., and personally examined the conditions existing in Tannery creek.

I find that the complainant, Mr. H. S. Armstrong, is a resident of the village, whose house is built on the banks of the creek about 1000 feet below the tannery complained of.

Mr. Armstrong complains of the odors arising from the creek and of the fact that the quality of the water has been so impaired that its use for irrigation has not been possible, the application of the water to his flowers killing or injuring the plants. Mr. Armstrong sells his flowers as a means of livelihood and experiences a definite pecuniary loss by the fouling of the water. Nearly opposite the tannery is a bath house, the water for which is supplied by wells, delivering so-called " black-water," evidently a solution of sulphur and salts. The odor of sulphurated hydrogen is plainly perceptible at the bath house but not in the stream, and the tannery ordor is very marked along the stream to a point below the village.

The proprietor of the bath house was not in Alden at the time of my visit but I examined the premises under the guidance of the clerk. The entire wastes of the establishment are discharged directly into the creek and direct evidence of the fœcal pollution was plainly visible.

The tannery employs from twenty-five to thirty men and makes sole leather, using for the purpose certain lime baths for cleaning and dehairing. The tannery building is old, though the superintendent is careful to keep the place as clean as possible. The company have built a cesspool which receives the waste from the washing machines. The hair taken from the hides and the particles of flesh, etc., removed in the preliminary processes are valuable and are supposed to be saved, and many bales of hair were seen ready for shipment. But in taking the hides from the lime tanks to the dehairing machine and to the scraping machine, the hides are dragged over the floor and by this means as well as by the fact that small quantities are continually dropped by the machine, the floor receives daily a considerable amount of organic matter. This material is washed by hose through holes in the floor into the creek directly underneath. The accumulations in the creek are clearly organic and come from the tannery, and the accumulation of organic matter is clearly responsible for the odors and pollution of the stream.

I recommend, therefore, that in accordance with the provisions of section 77 that Mr. H. Moffatt, Alden Tannery, Alden, Erie county, N. Y., be notified that the tannery is violating the provisions of the law and is, therefore, liable to the penalty prescribed by section 79d, and that a water-tight floor is required at once, the washings from which shall be received in a cesspool, the size of which shall be approved by this Department, and the outlet from which shall be properly screened.

Further, that any tannery liquor to be discharged into the creek shall first pass through a bed of sand at least three feet thick and of an area such that the flow through it shall be not greater than twenty gallons per square yard per day.

I also recommend that Mr. Eugene Paulter, proprietor of the Black Water bathhouse, be advised that he is violating sections 75 and 76, and that he is liable to the penalty specified in section 79d, and that permission will be granted to discharge into Tannery creek only after the construction of a cesspool, which shall contain at least 300 cubic feet.

Respectfully yours,
H. N. OGDEN,
Assistant Sanitary Engineer

As a result of the investigation, the following communications were sent out by the Department:

ALBANY, N. Y., *August* 6, 1907.

Mr. H. C. ASHBERY, *President of the Board of Health, Alden, N. Y.:*

DEAR SIR:— You are hereby notified, under the provisions of section 25 of the Public Health Law, to convene the local board of health, and enjoin the tannery in Alden from discharging contaminating poisons into Tannery creek, unless steps are at once entered into for the reduction of the nuisance which the discharge of their wastes into this stream is responsible for.

I advise you that apparently the wash from the floor of the tannery is responsible for the creation of the nuisance and that apparently some water-tight floor should be provided, or that the water may be received into the cesspool where the sedimentation of the solid organic matter may take place.

I suggest that the Tannery company be given a short definite period of time within which to make such changes. Will you kindly call the attention of the Tannery company to this section, 79d, under which the Tannery company is liable to a fine of $100, and $10 per day for each day the offense is maintained, and assure them that this Department will put the matter in the hands of the Attorney-General for collection at once unless we have definite assurance from them of their earnest intent to remedy the present conditions.

Respectfully yours,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *August* 6, 1907.

MR. H. MOFFATT, *Alden, N. Y.:*

DEAR SIR:— I desire to call your attention to the provisions of the Public Health Law, as expressed in sections 25 and 77, and advise you that this Department has examined the condition of the stream into which the wastes from your tannery discharge, and find the same to be a public nuisance.

In accordance with the provisions of section 25 I have notified the presiding officer of the local board of health to convene and take such steps as may be necessary to abate the nuisance at once. The inspector has reported to me the construction of a certain cesspool on your property which receives a portion of the tannery wastes and to that extent is satisfactory to this Department.

It appears that the floor-wash constitutes the worst nuisance, and it is to the elimination of this matter that your attention should be directed. I inclose a blank application which you should fill out and return to this office with a statement of your plans for reducing the present nuisance.

Respectfully yours,

EUGENE H. PORTER,

Commissioner of Health

ALBANY, N. Y., *August* 6, 1907.

MR. EUGENE PAULTER, *Alden, N. Y.:*

DEAR SIR:— I am advised that in defiance of the law you are discharging wastes from your bathhouse, unpurified, into Tannery creek.

I desire to call your attention to the provisions of the Public Health Law, as expressed in article 75, by which no person may discharge sewage or waste water of any sort into the public waters of this State without the express permission of the State Commissioner of Health.

Section 79d prescribes a penalty of $500, with a further penalty of $50 per day for each day the offense is maintained without such permission.

I advise you that this Department requires the construction by you of a cesspool for the reduction of the solid organic wastes discharged from your establishment, such cesspool to contain at least 300 cubic feet capacity, and I should be glad to hear from you at once as to your attitude in the matter.

Respectfully yours,

EUGENE H. PORTER,

Commissioner of Health

Further correspondence in the matter follows:

ALDEN, N. Y., *August* 22, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— In reply to your communication in regard to the Alden tannery, will say that the board of health convened and instructed me to notify Mr. Moffatt to discontinue running refuse into Tannery creek. Mr. Moffatt has agreed to close down the tannery and will not begin work again until such time as he can make such arrangements as will meet the approval of the board of health.

He would like some one to inspect the tannery and tell him just what he could do, and says he will try and put it in just such shape as the State Department may instruct.

Hoping this will meet with your approval, I remain,

Yours very truly,

C. E. BOWMAN,

Health Officer

ALBANY, N. Y., *August* 26, 1907.

C. E. BOWMAN, M.D., *Health Officer, Alden, Erie County*
N. Y.:

DEAR SIR:— I have your letter of August 22d, referring to the Alden tannery and to the fact that the owner, Mr. Moffatt, has agreed to close the tannery in lieu of making such changes on the place as shall prevent the discharge of the objectionable matter into the stream. If this is not done by the 1st of September, will you kindly notify me at once?

So far as suggesting to Mr. Moffatt what he should do, that is a matter which he must decide for himself. As I wrote him some time since, the principal source of pollution at present comes from his floor-wash, and I should think that a water-tight floor over which the washings might be led into a tank where the wastes might be precipitated would solve the difficulty.

Respectfully yours,

EUGENE H. PORTER,

Commissioner of Health

ALDEN, N. Y., *October* 10, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— In my reply to yours of August 26, I intended to make it plain to you, that unless Mr. Moffatt discontinued discharging matter into the creek by September 1st, would report the matter to you.

He has not put in any new stock since that time. Does not discharge anything into the creek. And as soon as the present stock is finished intends to fix up or discontinue running the tannery.

Yours very truly,

C. E. BOWMAN,
Health Officer

AMSTERDAM

ALBANY, N. Y., *May* 29, 1907.

Mr. THEODORE HORTON, *Consulting Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR:— I beg to report that, in accordance with your instructions, on May 27th and 28th, I investigated the complaint received by this Department from Mrs. Fred R. Greene, of Amsterdam, N. Y., relating to the pollution of Chuctanunda creek which flows through the central portion of the city.

The complaint alleged that a nuisance is created in said city by reason of the discharge of garbage, sewage and refuse into the waters of Chuctanunda creek.

A specific case is mentioned of a mill within two hundred feet of complainant's property in the rear part of which a closet is maintained which discharges directly into the stream.

The headwaters of Chuctanunda creek rise in the town of Galway, Saratoga county, northeast of the city. The drainage area of the stream at its mouth at the Mohawk river is about forty-one square miles. The upper portion of this drainage area, eight square miles in extent, is tributary to a storage reservoir of nearly one square mile area, constructed many years ago by joint agreement by the various mill owners whose plants are located along the stream in the city of Amsterdam and vicinity. During its ten mile flow from this reservoir to the Mohawk river in the city of Amsterdam, the stream falls nearly 600 feet. An area of about four square miles of the total drainage area of Chuctanunda creek is tributary to Bunn creek. Bunn creek empties into Chuctanunda creek just below the Sanford carpet mills near the central portion of the city, and is tributary to the distributing reservoir of the city water supply system, the reservoir being located on the lower portion of the watershed of Bunn creek.

In and near the city of Amsterdam, the Chuctanunda creek is largely used for power purposes. On its banks are located many large manufacturing establishments including carpet and rug mills, knitting mills, a linseed oil mill, a steel spring shop, broom factories, etc.

From nearly all of these manufactories, wastes developed by the various processes are discharged into the stream, and from many of the establishments, as may be noted in the accompanying information sheets, sewage is also discharged into the stream. The information sheets appended also present the number of pounds of dye stuffs and chemicals used daily in manufacturing processes, wastes from which are discharged into Chuctanunda creek.

Before undertaking the investigation, the health officer of the city, Dr. R. G. Johnson, was consulted, and he stated that the local board of health had received many complaints of the nuisance caused by the pollution of the stream. The conditions at the mills mentioned in the complaint had been investigated by the local health authorities, and the owners ordered to abate the nuisance which was caused by overhanging closets discharging directly into the stream and used by 150 employees. At the time of my inspection, the orders of the local board were being carried out, and work was under way to connect the closets with the Market street sewer of the city sewer system. Much time was saved in the investigation, and valuable aid was given by the cooperation of Sanitary Inspector Michael Jennings, of the city board of health.

In addition to the amount of sewage and manufacturing wastes discharged into the stream noted on the appended information sheets, sewage is discharged into the creek from the following residences and business properties:

Name of owner	Location of property
A. V. Morris	East Main street.
John Barnes	East Main street.
Charles Hubbs	East Main street.
Wm. Taylor, Estate	East Main street.
Frank Morris	East Main street.
Lottie M. Harvey	Chuctanunda street.
W. J. Stewart	Chuctanunda street.
Fred R. Greene	Market street.
M. L. Stover	Shuler street.

Following is a table presenting information, furnished by the manufacturers, in regard to the pollution of the stream from the ten manufacturing establishments in the city of Amsterdam, the town of Amsterdam, and the village of Hagaman, from which polluted wastes or sewage are discharged.

Respectfully submitted,
H. B. CLEVELAND,
Assistant Sanitary Engineer

Information Regarding Pollution of Chuctanunda Creek by Sewage and Wastes from Factories.

NAME OF FACTORY AND OWNER.	Location.	Number of employees.	Product.	Character and amount of wastes.	Domestic sewage discharged.
Star Knitting Mill—L. E. Harrower.	Hagaman.....	175	600 dozen knit underwear daily.	No dyeing; 150 barrels 350 pounds each of soap and 15 barrels alkali used yearly in washing.	From 5 closets serving 175 employees.
Anchor Knitting Mill—L. E. Harrower.	Hagaman.....	225	500 dozen knit underwear daily.	No dyeing; 200 barrels 350 pounds each of soap and 10 barrels alkali used yearly in washing.	From 225 employees.
Rural Knitting Mill—L. E. Harrower.	Town of Amsterdam.	200	450 dozen knit underwear daily.	No dyeing; 175 barrels 350 pounds each of soap and 17.5 barrels alkali used yearly in washing.	From 5 closets serving 200 employees.
Park Knitting Mill—L. L. Dean & Co.	Amsterdam...	100	100 dozen knit underwear daily.	21,820 pounds cottonseed oil per year (90% waste); 20,000 pounds alkali per year (90% waste); 3,700 dyestuffs per year (2–3% waste); 28,800 pounds sulphuric acid per year; 20,800 pounds Glaubers salts per year (90% waste).	From 100 employees.
McCleary, Wallin & Crouse Co.—Wm. McCleary, Pres.	Amsterdam...	1,500	18,000,000 square feet Smyrna carpets, rugs and tapestries yearly.	Soap, 35,000 pounds per year, about 90% waste; Glaubers salts 425,000 pounds per year; sulphuric acid, 210,000 pounds per year; carbonate of potash, 90,000 pounds per year (90% waste); aniline dyes, 80,000 pounds per year (5% waste).	From 1,300 employees.
Stephen Sanford & Sons....	Amsterdam...	2,600	5,550,000 yards of carpets and rugs yearly.	Amount of chemicals and wastes discharged into stream was stated by owner to be very limited.	Connected with city sewer system.
Gardner Broom Co........	Amsterdam...	80–85	Brooms...........	No factory wastes...	Sewage from 80–85 employees.
Chuctanunda Knitting Mills—John K. Stewart & Sons	Amsterdam...	750	Underwear and cotton yarn.	20 pounds to 25 pounds aniline and Egyptian dyes used daily.	Sewage from 600 employees.
A. V. Morris & Sons Mills' Nos. 1 and 4.	Amsterdam...	543	2,800 dozen knit underwear per year.	1 gallon sulphuric; 10 pounds aniline dyes; 150 pounds alkali; 22 gallons bleaching fluid, daily.	None.
H. Chalmers & Son	Amsterdam...	250	15,000 gross pearl buttons daily.	200 pounds muriatic acid (80% waste)..	Sewage from 200 employees.

ALBANY, N. Y., *August* 1, 1907.

ᴎᴇ H. PORTER, *State Commissioner of Health, Albany,*
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ᴵᴿ:— In response to your request I have reviewed the
the pollution of Chuctanunda creek in the city of
n, occasioned by the discharge of wastes from manu-
establishments located along the creek in and near

lution of this stream was investigated by the writer on
and 28th of this year and reported upon to Theodore
Chief Engineer of this Department. By reference
ort and the accompanying information sheets it will be
the wastes from a considerable quantity of soaps, dye
chemicals are discharged daily into the stream as well
rable sanitary sewage. The stream shows the effect of
rge to a marked degree. In the lower section, near its
the Mohawk river, the entire stream is discolored and
g during low water stage, now showing one color and
er across the entire cross-section.

ly feasible means of removing the pollution from the
s in the connecting of the mills in the city with the city
em. Several mills at present discharge all sanitary or
ge into the sewer system.

thetic benefits to be derived from freeing the Chucta-
ek from pollution, so that it might flow through the
r stream, not giving off offensive odors nor presenting
able filthy appearance as at present, would be very much
d by residents along its course as well as by the general
n regard to any actual menace to health occurring dur-
w through the city arising from the pollution of this
am of the opinion that the danger is very small, since
nunda creek is not used for water supply.

greater importance to the public health is the pollution
lic water supply for several large cities on the Hudson
ch, though many miles distant, are directly concerned
threatened by the pollution of the Mohawk river.

stion of the treatment of the entire sewage of the city of Amsterdam has been already taken up by this Department and without doubt the purification of the entire domestic and manufacturing wastes before discharge into the Mohawk river will b accomplished within a few years.

In view of the foregoing, it might be expedient to defer acti on the removal of pollution from Chuctanunda creek until su time as provision is made for the treatment of all wastes befo discharge into the Mohawk.

Respectfully submitted,
H. B. CLEVELAND,
Assistant Sanitary Engineer

BIG MOOSE LAKE

PORTLAND, MAINE, *September* 16, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I have the honor to report that on Saturday, September 7, 1907, I visited Big Moose lake, on account of complaints received from Mr. A. S. Hamilton under date of August 26, 1907, and from Dr. A. Vander Veer, under date of August 27, 1907.

I find the conditions to be as follows: Big Moose is one of the larger Adirondack lakes, about three miles long and three-quarters of a mile wide. The west end of the lake is about two miles from Big Moose station on the N. Y. C. & H. R. R. R. and is thus easily accessible for summer tourists. A steamboat on the lake makes the shores available for cottages and hotels, although, as yet, comparatively few buildings have been erected. The usual practice of all the houses provided with modern plumbing is to discharge the sewage directly into the waters of the lake, in most cases carrying the outfall pipe into such a depth of water that the discharge is not directly objectionable to the senses.

The hotels claim to use only spring water for drinking purposes, though they acknowledge that they depend on the lake as the source of general water supply for all other domestic purposes. One of the hotels, the Hotel Glenmore, at the time of the writer's visit, was pumping water from the lake and using it for drinking purposes, although sewage was discharged into the lake not far away. The sewer from the hotel known as Burdick's Camp was discharging sewage in large quantities in close proximity to a pipe apparently used for supplying water to the hotel. A large new cottage, built by Mr. Kingsford of Oswego, has an elaborate system of sewers discharging directly into the lake. These conditions cannot fail to be prejudicial to the health of the guests of the hotels and might easily lead to a serious epidemic. I recomment, therefore, that the Department write to each of the hotels, named below, personal letters, calling attention to the existing dangers and asking that, in the interests of their guests, an attempt be made to secure an upland water supply for all domestic purposes.

I recommend also that they be directed to discontinue all direct discharge of sewage into the lake, and that properly dimensioned sedimentation tanks be constructed on the line of each outfall pipe.

I recommend also that the hotels be advised that, failing a proper revision of the water supply system and the sewer discharge pipe, the Department will feel obliged to call the attention of the public to the danger of patronizing such indifferent hotels.

List of hotels on Big Moose lake:

Burdick Camp, Big Moose, Herkimer county.
Camp Crag, Big Moose, Herkimer county.
Dort's Camp, Big Moose, Herkimer county.
Glenmore Hotel, Big Moose, Herkimer county.
Higby Camp, Big Moose, Herkimer county.
Lake View Lodge, Big Moose, Herkimer county.
Skilton's Lodge, Big Moose, Herkimer county.

Yours respectfully,

H. N. OGDEN,
Assistant Sanitary Engineer

On September 30 a letter similar to the one sent out to hotel and camp owners on Fourth lake was sent to owners of hotels and camps on Big Moose lake. A copy of this letter is found under "Fourth Lake" in this report.

CORTLAND

During June complaint was received of the polluted condition of the Tionghnioga river below the city of Cortland, especially on account of the wastes from the Wickwire Brothers plant.

The matter was taken up with the Wickwire Bros. Company and a disposal plant is now being constructed to reduce the acid iron wastes now discharged into the stream from the plant.

EAST SALAMANCA

On August 14th complaint was received from Charles J. Nagel, of East Salamanca, that sewage was being discharged into Great Valley creek, near his residence, from the shops of the B. R. & P. R. R. thereby creating a nuisance.

Later one of the engineers investigated the complaint and found that the old railroad sewer, laid by the Y. M. C. A., was completely closed and out of use and that all discharge of sewage into the stream at that time was at a point about one mile below the complainant's house.

FOURTH LAKE

PORTLAND, MAINE, *September* 16, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:—I have the honor to report that on Friday, September 6, 1907, I visited Fourth Lake on account of statements made to you by A. S. Hamilton, under date of August 26, 1907, and by Hon. Thos. D. Ferguson, under date of August 19, 1907.

I find that Fourth lake is one of the larger Adirondack lakes, about five and one-half miles long and about three-quarters of a mile wide, receiving waters from Fifth Lake and from Eagle creek and discharging into Third Lake and finally into the middle branch of the Moose river at Old Forge. The Raquette Lake railroad, running from Clearwater to Raquette lake, skirts its northern edge and a steamboat line operating three boats makes connection between Old Forge and all the lake points.

On account of their easy access the shores are well sprinkled with hotels, boarding houses, and cottages, which are well filled during the summer season. The usual practice of all the houses, provided with modern plumbing, is to discharge the sewage directly into the waters of the lake, in most cases carrying the outfall pipe into such a depth of water that the discharge is not directly objectionable to the senses. There is some evidence of garbage along the shores and it was stated that one of the hotels, the Cedar Island Camp, has been in the habit of regularly dumping its garbage into the lake.

The hotels claim to use only spring water for drinking purposes, though they acknowledge that they depend on the lake as the source of general water supply for all other domestic purposes. One of the hotels, the Rocky Point Inn, is said to occasionally use the lake water for drinking purposes, even although its sewer discharges not far from the end of the water inlet pipe.

These considerations cannot fail to be prejudicial to the health of the guests of the hotels and might easily lead to a serious epidemic. I recommend, therefore, that the Department write to each of the hotels named below, personal letters, calling attention to the existing dangers and asking that, in the interests of their guests, an attempt be made to secure an upland water supply for all domestic purposes.

I recommend also that they be directed to discontinue all direct discharge of sewage into the lake, and that properly dimensioned sedimentation tanks be constructed on the line of each outfall pipe.

I recommend also that the hotels be advised that, failing a proper revision of the water supply system and the sewer discharge pipes, the Department will feel obliged to call the attention of the public to the danger of patronizing such indifferent hotels.

The list of hotels on Fourth Lake is as follows:

The Arrow Head, Inlet, Hamilton county.
Cedar Island Camp, Old Forge, Hamilton county.
The Cohasset, Old Forge, Hamilton county.
The Eagle Bay Hotel, Eagle Bay, Hamilton county.
Grand View House, Inlet, Hamilton county.
Hart's Camp, Eagle Bay, Hamilton county.
Inlet Inn, Inlet, Hamilton county.
Kinmore Hotel, Old Forge, Hamilton county.
The Mohawk Camp, Old Forge, Hamilton county.
The Neodack, Inlet, Hamilton county.
Rocky Point Inn, Eagle Bay, Hamilton county.
Bald Mountain House, Old Forge, Hamilton county.
Crystal Spring Camp, Old Forge, Hamilton county.
Manhasset House, Old Forge, Hamilton county.
Twin Maple Camp, Old Forge, Hamilton county.

Respectfully submitted,
HENRY N. OGDEN,
Acting Consulting Engineer

On September 30, 1907, the following letter was addressed to the proprietors of the various hotels listed in the foregoing report:

ALBANY, N. Y., *September* 30, 1907.

DEAR SIR:— This Department has been engaged, during the past summer, in an inspection of a large number of summer resorts, hotels and boarding houses throughout the State. During our investigation of the conditions at Fourth Lake, our inspector reports that it is the usual practice of all the houses on the lake. provided with modern plumbing, to discharge the sewage directly into the waters of the lake, although in most cases carrying the outfall pipe into quite a depth of water. It is also stated that in several of the hotels the lake water is occasionally used for drinking purposes.

Section 75 of the Public Health Law prohibits the discharge of sewage into the waters of this State without the express permission of the State Commissioner of Health. I regard the discharge of sewage from a summer hotel into a lake or body of water used as a potable water supply by guests of the hotel as a dangerous practice and one which might easily lead to a serious epidemic. I therefore call your attention to the provisions of law above noted and to the prevailing danger, and ask that in the interests of your guests, an attempt be made to secure an upland water supply for all domestic purposes so that there may be no necessity for resorting to lake water.

I would further recommend that arrangements be made to discontinue the direct discharge of sewage into the lake and that properly dimensioned sedimentation tanks be constructed on the line of each outfall pipe.

A notice similar to this will be sent to the other hotels and camps on the lake as the Department wishes to give you every opportunity to comply with these recommendations before the opening of your next season. I feel, however, that should any of these hotels fail to make a proper revision of the water supply system and the sewage discharge pipes, that the Department will feel obliged to call the attention of the public to the danger of patronizing hotels making such indifferent sanitary arrangements for the protection of their guests.

Your attention is therefore directed to this matter in order that you may have ample opportunity to make the necessary changes and I should be glad to hear from you as to what action you propose to take with reference to the matter.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

HAMPTON

POLLUTION OF POULTNEY RIVER

ALBANY, N. Y., *October* 17, 1907.

THEODORE HORTON, *Chief Engineer, State Department of Health, Albany, N. Y.*

DEAR SIR:— I beg to submit the following report of my investigation of the pollution of the Poultney river, undertaken at the request of Commissioner Porter, in response to a petition from T. D. Southworth of the town of Hampton, N. Y. Appeal was made to the Department for aid in preventing the pollution of the Poultney river by the discharge of sewage from the village of Poultney, Vermont.

On April 10, 1907, Mr. Southworth submitted to the Department a statement of the conditions which called forth his appeal. After the matter had been taken up by this Department with the health authorities of the State of Vermont, Mr. Southworth again wrote to the Department on August 13th, remarking on the low stage of water in the river and the filthy conditions occasioned by the sewage discharge.

The investigation was made on August 26th and 27th, and was undertaken for the twofold purpose of making a sanitary inspection of the entire Poultney river watershed with relation to stream pollution and of examining into the complaint of Mr. Southworth.

A statement of the general sanitary condition of the watershed, including a description of the river, the amount of pollution received by the river, the flow etc., will first be made, after which the specific instance of pollution caused by the discharge of sewage from Poultney, Vermont, will be taken up.

The Poultney river rises in the town of Tinmouth, Rutland county, Vermont, and flows easterly for a distance of fourteen miles to the village of Poultney. From Poultney, the direction of flow is northerly for eleven miles, passing through the village of Fairhaven about two miles to the westward, where it is joined by Castleton river and continuing northward as far as Carver Falls, where the river takes an abrupt turn to the westward, flowing in this direction for four and one-half miles. Its general direction is then southwesterly for five and one-half miles to East bay of Lake Champlain, near the northerly limits of Whitehall.

From Poultney to Lake Champlain, the river forms the boundary line between the States of New York and Vermont. This boundary line was established in 1790 as follows:

> "Beginning at the northwest corner of the State of Massachusetts, thence westward along the south boundary of Pownal to the southwest corner thereof, thence northerly along the western boundary of the townships, of Pownal, Bennington, Shaftsbury, Arlington, Sandgate, Rupert, Wawlet, Wells and Poultney, as the said townships are now held or possessed, to the river commonly called Poultney river, thence down the same to the middle of the deepest channel thereof to East Bay, thence through the middle of the deepest channel of East Bay and the waters thereof, to where the same communicate with Lake Champlain, thence through the middle of the deepest channel of Lake Champlain to the eastward of the islands called the Four Brothers, and the westward of the islands called the Grand Isle and Long Isle or the Two Heroes, and to the westward of the Isle of La Mott to the forty-fifth degree of north latitude."

The character of the watershed is that of a farming and quarrying country, and the valleys are fairly well cleared, while the steeper hills and mountainous regions are well covered with forests. The drainage area of the Poultney river above the village of Poultney is about thirty square miles, and the drainage area at the mouth of the river is 270 square miles.

The population on the watershed is rather sparse, and, therefore, in a consideration of the pollution of the river, it is necessary to list the population of the villages only on the watershed. These villages are here named:

On the Poultney river: Middletown Springs, Vt., population 500; East Poultney, Vt., population 300; Poultney, Vt., population 2,000; Hampton, N. Y., small hamlet.

On the Castleton river which is the only important tributary of the Poultney river, are located the villages of:

Castleton, Vt., population 700; Hydeville, Vt., small hamlet; Fair Haven, Vt., population 3,000.

In a discussion of the pollution of the rivers, two classes of wastes are to be considered:

First.— With respect to manufacturing wastes, it may be said that from a sanitary standpoint this class of waste may be disregarded in the case of the Poultney river, since the only considerable waste from manufacturing is that derived from the twelve or fifteen slate mills located on the river and its tributaries. The discharge from these mills consists of ground slate and sand used in grinding the slate for commercial purposes.

Second.— In respect to sewage pollution, a description of the conditions of pollution at each of the villages above-mentioned will be given:

Middletown Springs

The population of this place is 500. It was learned from reliable authority that no sewers discharged into the Poultney river in this village.

East Poultney

From an investigation of the conditions at East Poultney and a conference with members of the board of health, it was learned that no sewers discharged into the river at East Poultney. The condition of the stream below East Poultney bore out the above statement, since no visible evidence whatever of sewage pollution of the river could be discerned.

Poultney

At the village of Poultney there are at present two sewer outlets serving approximately 400 people. The one in the rear of the Troy Conference Academy has been in use for some time as a private sewer, but it is understood that this sewer is to be taken over by the village. The general sewer system was constructed during the fall of 1906, but connections were not generally made until the spring of 1907. The population of Poultney, including 130 at the Troy Conference Academy, is about 2,000.

Castleton

The village of Castleton on the Castleton river has no sewer system and no sewage is discharged directly into the river. The population is 600, and in addition there are 100 persons at the State Normal School when in session. The sewage from this school is discharged into a cesspool some distance from the river.

Hydeville

This is a small hamlet and does not contribute any pollution to the river.

Bomoseen Lake

Just below Hydeville, the outlet of Lake Bomoseen joins Castleton river. Around the shores of this lake, there are located five or six hotels, having a guest capacity of from 50 to 250, and 125 cottages. Practically all of the hotels and cottages have inside closets and discharge sewage into the lake, the water supply being derived from springs and wells on the hillsides to the rear of the hotels and cottages. It is estimated that sewage from 1,200 persons is discharged into the lake during the summer season. It was stated by Dr. E. R. Clark of Castleton, health officer for the town of Castleton, that no complaints have been received by reason of any nuisance created by this sewage discharge.

Fair Haven

At Fair Haven the public sewer system was completed in 1904, the sewage being discharged into the Castleton river from three separate outlets. The number of persons served by the sewer system is about 1,500. The water supply of Fair Haven is furnished by gravity from Inman pond.

Below Fair Haven there is practically no pollution added to the stream.

The summer flow of the Poultney river at Hampton, just below Poultney, on the basis of 0.2 sec. feet per square mile of drainage area is about six cubic feet per second. A rough gauging of the stream at this point at the time of the inspection gave a flow amounting to less than 0.1 sec. feet per square mile. At the mouth of the river, with a drainage area of 270 square miles, on a basis of 0.2 sec. feet per square mile, the flow would be fifty-four cubic feet per second. At Carver Falls, a water power electric lighting plant has been in operation for several years. Gaugings of the dry weather flow made by the water power company substantiate the above basis assumed of 0.2 sec. feet per square mile for the summer flow of the river.

The present daily sewage contribution to the Poultney river, on the basis of 100 gallons per person served by sewage discharging into the river and tributaries is as follows:

At Poultney	40,000 gallons
At mouth	310,000 gallons

On the basis of summer flow above stated, at a point below the main sewer outlet from Poultney, this will give a flow of fifteen cubic feet per second per 1,000 persons served by sewers discharging into the river, and a summer flow at the mouth of the river of seventeen cubic feet per second per 1,000 persons served by sewers discharging into the river and tributaries.

Under ordinary conditions, if a dry weather flow of 0.2 of a cubic feet per second per square mile of drainage area be assumed as the yield from the watershed above Poultney, and if the number of sewer connections in Poultney were not to be increased, the stream would not be considered by sanitary standards to be grossly polluted or to be in immediate danger of gross pollution; but as stated above, the flow was less than 0.1 second feet at the time of the inspection, and the result of the sewage discharge was to create a decided nuisance.

Considering now the pollution of the Poultney river as effecting the property and riparian rights of the complainant:

The property of Mr. Southworth is located mainly on the west bank of the Poultney river in the town of Hampton, about one mile from the village of Poultney, and consists of a dairy farm of about 250 acres. Thirty or forty acres of the farm, through which the Poultney river flows, are used as a night pasture for stock.

The main outlet sewer of the Poultney sewer system discharges into the river at a point several hundred feet down stream from the upstream limit of the property.

With respect to the pollution of the river occurring at the property of the complainant, it was observed that, although the amount of the discharge from the sewer outlets at the time of the inspection was comparatively small, the stream was very badly polluted and gave off offensive odors.

It was stated by Mr. Southworth that his cattle refused to drink the water in the stream. Especially below the point of discharge of the main trunk sewer, the water was discolored and rank sewage growths appeared on the bed of the stream for a half mile or more below the sewer outlet. As noted above, the flow in the river was very low at the time of inspection, being probably not over three cubic feet per second, but it should be borne in mind that while such a low stage of the river may not occur every season or for protracted periods, the sewage discharge from the village of Poultney is very likely to be increased three or four times in amount within a few years. In any event, since the dry weather flow of the stream during any season is not likely to be more than double that noted, a nuisance will continually result, during the summer months, from the discharge of raw sewage from Poultney into the Poultney river until such time as treatment or reduction of this sewage is effected before its final discharge into the stream.

Summarizing the conclusions reached during the investigation, it may be said:

1. That the present pollution of the Poultney river, except that existing near the village of Poultney, does not constitute a nuisance in view of the fact that no public water supplies are derived from the river, although if the amount of sewage discharged into the river were to be increased, say 100 per cent., a condition of nuisance would probably result irrespective of the question of water supply.

2. That the Poultney river immediately below the outfall sewers from the village of Poultney, is, by reason of the discharge of raw sewage from the village of Poultney, polluted to such an extent as to cause a nuisance and to result in injury to the property and impairment of the riparian rights of the complainant.

Respectfully submitted,

H. B. CLEVELAND,
Assistant Engineer

ALBANY, N. Y., *November* 27, 1907.

Hon. WILLIAM S. JACKSON, *Attorney-General, Albany, N. Y.*

DEAR SIR:—An appeal has been made to this Department by Mr. T. D. Southworth of the town of Hampton, for aid in preventing the pollution of the Poultney river by sewage from the village of Poultney, Vt.

We have given the complaint of Mr. Southworth careful consideration and made a careful investigation and sanitary inspection of the Poultney watershed. I beg to enclose you herewith a copy of the report of our sanitary engineer covering the matter thoroughly.

The complaint of Mr. Southworth, who is a riparian owner in the town of Hampton and the county of Washington, signed by a number of other residents and riparian owners on the Poultney river, alleges that the Poultney river is a boundary line between the town of Hampton, N. Y., and the village of Poultney, Vt., and runs through and along the property of the said petitioner for a distance of more than half a mile. The water of the Poultney river has always been used by these riparian owners for their domestic animals and for household uses.

The village of Poultney has prepared plans for a system of sewers and has proceeded to construct the same, the main outfall of which discharges into the river at a point about opposite the property of Mr. Southworth. It appears from the report of our engineer that the Poultney river immediately below the outfall sewers from the village of Poultney is, by reason of the discharge of raw sewage from the village of Poultney, polluted to such an extent as to cause a nuisance and to result in injury to the property and impairment of the riparian rights of the complainant.

This Department communicated with the State Board of Health of Vermont, asking if any permission had been given by that Board for construction of this sewer system discharging into the Poultney river, and I am advised by them that they were informed by the Attorney-General of the State that legislation in the State upon the subject of pollution of streams was not broad enough to authorize the Board to prohibit the pollution of streams that are not used as sources of domestic water supply in that state, or to prevent the pollution of streams running into another state. They are therefore unable to aid us in the work.

The appeal of the riparian owners along the Poultney river has been made to this Department in the belief that we would have some authority to remedy the existing conditions. I therefore beg you to advise me if there is any action that this Department can take to restrain the village of Poultney from continuing this discharge of sewage which apparently constitutes a nuisance, and if any action or proceeding can be taken by this Department, I will be glad to submit to you such evidence as may be necessary.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

Subsequently the Attorney-General advised the Department that there was no action it could take in this matter, the parties would have to seek redress in the Vermont courts.

HANCOCK

Complaints were received from the board of health of the village of Hancock of the pollution of a small brook which runs through the greater length of the village.

An inspection was made and the following were suggested as remedies of the existing nuisance:

1. By discarding all the present sewers and constructing a sewerage system for the village.
2. By allowing all sewers to remain except the creek sewer, and by replacing that by a pipe of proper size laid on a suitable grade.

The board of health was advised to convene and issue formal orders directing that all connections with the present drain laid in the bed of the creek be discontinued under penalty of the law. It was further pointed out that it might be more feasible for the board to require the construction and maintenance of water-tight cesspools, but one of the two actions was strongly advised.

HANNAWA FALLS

PORTLAND, MAINE, *September* 16, 1907.

E. H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.*

DEAR SIR:— I desire to report that, in connection with the visit made to Piercefield on account of the complaint made by the president of the Jordan club at Hollywood, I inspected the water works of the village of Potsdam, which is situated on the Racquette river about thirty miles below Hollywood and about fifty miles below the Piercefield mill. Between Piercefield and Potsdam are three small villages, South Colton, Colton and Hannawa Falls, the latter being about four miles upstream from Potsdam. At Hannawa Falls is a pulp mill, the wastes from which are added to the contamination already present in the stream. The village of Potsdam gets its water supply from the river pumping into a reservoir for pressure. The quality of the supply is very poor, the water being highly colored and containing large quantities of the slimy, mucilaginous fibre. I recommend that if any general action is taken by authority of the State, tending to decrease the direct discharge of pulp mill refuse into the waters of the State, that such action include the mill at Hannawa Falls, particularly in reference to the discharge of fibre and that a personal letter be written at once to Hannawa Falls Water Power Company with a view of enlisting their co-operation in the matter of keeping such fibre out of the stream by a series of adequate screens.

Yours respectfully,
HENRY N. OGDEN,
Acting Consulting Engineer

ALBANY, N. Y., *September* 25, 1907.

HANNAWA FALLS WATER POWER COMPANY, *Hannawa Falls, N. Y.*

GENTLEMEN:— One of our sanitary engineers recently completed an inspection of sanitary conditions along the Racquette river and he advises me that your sulphite pulp mill at Hannawa Falls adds its wastes to the contamination already present in the stream.

As you are probably aware, the village of Potsdam gets its water supply from the river, pumping into a reservoir for the pressure. The quality of the supply is very poor, the water being highly colored and containing large quantities of the slimy, mucilaginous fibre.

You may have heard that the Department is investigating the subject of the discharge of refuse from sulphite pulp mills into the waters of this State, under an order of the Governor, and that it is very probable that some action will be taken by the State looking toward the elimination of these wastes in such waters.

Before undertaking any action of any kind against your mill, I am writing you with a view of enlisting your co-operation in the matter of keeping the fibre out of the stream by a series of adequate screens.

I understand that by the construction of such screens a very large amount of the fibre which at present goes into the stream can be retained. I would be glad to hear from you as to what action your company would be willing to take voluntarily in this matter.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health.

POTSDAM, N. Y., *October* 4, 1907.

DR. EUGENE H. PORTER, *Department of Health, Albany, N. Y.:*

MY DEAR DR. PORTER:— I have your letter of September 25th and note contents. Whatever fibre is wasted is a dead loss to our company. You may be sure that we are making every possible effort to save it and keep it out of the water. I am in hopes of perfecting a system to a point where there will be no waste whatever, because every ounce that goes away from us is a dead loss.

We discharge no sulphite liquors, or anything of that sort, and the only thing that gets away from us is a small quantity of ground wood which our present system does not take up, and that no other mill is able to save.

You may count on my hearty co-operation in any effort you may be making along the line you suggest.

Very truly yours,

EDWIN A. MERRITT, JR.,

Receiver

HARRISON

In the Twenty-seventh Annual Report, page 704, reference is made to an investigation of the pollution of Beaver brook in the villages of Harrison and Rye.

On January 25, 1907, the following permit was granted:

ALBANY, N. Y., *January* 25, 1907.

L. E. PEELER, M. D., *Health Officer, Town of Harrison, N. Y.*

DEAR SIR:— Application having been duly made by the town of Harrison through its board of health, dated January 16, 1907, permission is hereby given the authorities having charge of the sewerage of said town to construct a channel through the low marshland east of the town line between Harrison and Rye, and to continue the discharge of sewage now entering the tributary of Beaver brook traversing said lowland, through said proposed channel, for a period of one year from the date of issue of this permit upon the following conditions:

(*a*) That plans for a sewerage system for the portion of the town of Harrison now including the village of Harrison be prepared and submitted to the State Department of Health for approval before the expiration of the time of this permit.

(*b*) That if said plans be not submitted and approved by the State Department of Health before the expiration of the time of this permit, said permit may be revoked by the State Commissioner of Health and the town of Harrison shall thereupon cease to discharge any sewage into said tributary of Beaver brook.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

HOLLEY

ALBANY, N. Y., *December* 7, 1907.

THEODORE HORTON, *Chief Engineer, State Department of Health,*
Albany, N. Y.

DEAR SIR:— I beg to submit herewith the following report on the pollution of Spring brook in Holley, Orleans county, N. Y., in compliance with your request to investigate the complaint of Mrs. Margaret Sullivan, received October 22, 1907.

In her letter to the Department, Mrs. Sullivan complains of the pollution of a stream, Spring brook, which runs in front of her house and refers to it as a "filthy sewer" and says that she is "unable to stand the smell" from it.

In my conversation with Mrs. Sullivan, she admitted that conditions had been greatly alleviated by the construction of a private sewer, along the west side of the street on which her house faces, which intercepts the drainage from the houses on that side of the street. The complaint of odor from Spring brook and the grease on its surface was still maintained. It was further held by the complainant that she and her neighbors had no facilities for drainage provided them, and that the block in which she lives suffered from the resulting accumulation of surface water, kitchen waste, and ground water.

I visited the village of Holley on November 27th and the existing conditions as found by field inspection are as follows: Spring brook intercepts from Sandy creek a very small amount of water through a partially dammed culvert running under the N. Y. C. R. R. fill. It continues through a tile drain to the southern corner of the complainant's property where it runs in an open trench for about 300 feet when it again enters a stone drain, turns eastward and returning to open trench flows through the block in question and on to the channel of the old alignment of the Erie canal. In front of the complainant's house, grease appeared on the water and there was a cider odor from the brook. There is a cider mill about 1,000 feet west from the complainant's house and a drain was said by the foreman of mill to enter Sandy creek above the point of the interception of water by Spring brook.

In the evening there is this slight odor arising undoubtedly from the stream in front of Mrs. Sullivan's house, but when the mill is operating it is lost in the odor in the air coming from the same source. I could find no house laterals discharging into Spring brook, though they may have existed previous to the construction of the private sewer referred to above.

As far as could be ascertained there is no use made of Spring brook at the present time. The village of Holley has a water supply and the flow of the brook is unappreciable as a feeder to the canal. Except for the present interception of Spring brook, the water would take the course of Sandy creek.

As to the further complaint as to no facilities for drainage, I found that the complainant's yard was about seven feet below the road in front of her house and the sewer there could be of no help to her. The complainant and her neighbors are draining their cellars and kitchen wastes in open ditches either across the road or to lower ground in the same block, leaving the surface marshy and in many places filthy.

The original complaint of Mrs. Sullivan has already been remedied by the private sewer, completed this fall, running in the street on which she fronts. Any further complaint may be guarded against by the complete damming of the culvert at the head of Spring brook. Unless the existence of this stream has some legal aspect in connection with the canal or otherwise, there is now no apparent reason for its continuance.

The further need of drainage facilities may be supplied by the construction of a sewer, starting near the center of the block in which Mrs. Sullivan lives, running eastward to easterly bounding street, southerly down this street and continuing to the ravine of Sandy creek.

Plans for a complete sewerage system and disposal plant were made by Mr. George Rafter, consulting engineer for the village, and approved by this Department in 1890. These plans provide for the demands of the block in question by such a sewer as described above but they have not as yet been executed. Furthermore the existing sewers have been constructed contrary to the aforesaid plans, the grades revised and alignment changed. If the sewer built last summer had been constructed according to

Mr. Rafter's plans, it would have turned to run south of Mrs. Sullivan's house and dropped to an elevation that would have made a house lateral possible for her.

Furthermore, within a few years, the disposal plant will probably have to be built, and other extensions of the sewerage system made at random, will complicate the interception of the sewage and its conveyance to such a plant.

In summary of the foregoing, I conclude:

1. That the original complaint of Mrs. Sullivan has been remedied by the private sewer of late constructed in the street on which her house fronts.

2. That further complaint of the conditions of Spring brook may be obviated by the discontinuance of the brook, provided there is no legal aspect obtaining in the case.

3. That the need of drainage facilities for the block in which Mrs. Sullivan lives, may be supplied by the construction of such a sewer as originally planned for the block in the approved plans for the village sewer system.

4. That further deviation from these plans in the construction of sewers will complete the problem of interception and sewage treatment which will soon be required.

And further, I beg to recommend:

1. That Spring brook be discontinued, unless some use or legal reason can be shown for its existence.

2. That the trustees of the village construct the sewer planned for the block in question, and that in all future extensions they be strongly advised to rigidly conform to the existing plans for such extensions.

Respectfully submitted,

HENRY W. TAYLOR,
Assistant Engineer

ALBANY, N. Y., *December* 9, 1907.

HON. CHARLES W. CLOUGH, *President of the Village, Holley, N. Y.*

DEAR SIR:— I beg to inform you that during a recent inspection by one of our engineers in regard to the sanitary conditions of a portion of your village, it was discovered that the sewers in the streets of the village in the vicinity of Batavia, Main and State streets, have not been constructed in accordance with the plans originally filed and approved by this Department in April, 1890.

It appears that the sewer on Main street, from Thomas street, running southerly, has not followed the original alignment which, starting at Thomas, runs through Main to Batavia, thence down Batavia about 100 feet and then crosses private property to Sandy Creek. If the construction of this sewer had been carried out in accordance with the original plans, it would have been possible for the property owners on Batavia street, between Main and State streets, to properly dispose of their sewage, whereas at the present time no such sewer is provided in Batavia street in accordance with the original plans, and the sewer on Main street is too high for the purpose.

I wish, therefore, to call your attention to the fact that the construction of the sewer on Main street, from Thomas street south, crossing the N. Y. C. R. R. and private property to Sandy Creek, is in violation of the Public Health Law, and that no authority was given for this modification of the plans; and to point out to you the serious consequences of not following the original plans as shown in the present case.

I wish, in addition, to emphasize that in the future it will be necessary for you to comply strictly with the law and that if you desire any modifications of the plans, as originally approved, it will be necessary for you to make application for the approval of such modifications before any construction is carried out.

I wish further to call your attention to a matter in regard to the complaint recently received from Mrs. Sullivan, of your village, in regard to the small stream called Spring Brook which runs near or through her property. The report of our engineer, who investigated the complaint, indicates that this stream is not used for any particular purpose at the present time and that since it may possibly be the source of nuisance in the future, it would be well to cut off this stream entirely unless there are legal complications involved as affecting the State canal.

It appears that Sandy Creek, above the point of diversion into Spring Brook, receives some pollution of an industrial character and that by cutting off Spring Brook any nuisance arising from this pollution would be removed.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *December* 9, 1907.

MRS. MARGARET SULLIVAN, *Holley, N. Y.*

DEAR MADAM:— Replying further in the matter of the nuisance complained of by you in regard to Spring Brook, I beg to say that this matter has been carefully investigated by one of the engineers of this Department and I am now in receipt of his report setting forth the facts in regard to the same.

It appears from his report that your original complaint in regard to the odors and nuisance arising from the sewage pollution of this stream has been remedied and that during his inspection he found no evidence that such insanitary conditions existed.

The report of our engineer calls attention to the fact that at the present time no particular use is made of Spring Brook and that, unless this stream is required by the Canal Board, he recommends that it be cut off and disused. In a letter to the village authorities I am calling their attention also to this matter.

In regard to the need for sewer improvements, along your street, I beg to say that after plans have been submitted and approved by this Department, the construction of sewers is a matter not under my jurisdiction but is under the authority of the local board having charge of the construction and operation of the sewerage system. I would, therefore, refer you to your local sewer committee and suggest that you take the matter up with them, securing, so far as possible, the co-operation of the local board of health, and secure the construction of the sewer in question.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

HUDSON RIVER

ALBANY, N. Y., *October* 9, 1906.

ALEC H. SEYMOUR, ESQ., *Secretary, State Department of Health, Albany, N. Y.*

MY DEAR MR. SEYMOUR:— I have been urged by a number of persons, together with a rod and gun club, to endeavor to stock several streams in the northern portion of Rensselaer county with fry, to the end that these streams may give us the fishing which heretofore existed.

I find, however, upon a cursory examination that the water in the streams under consideration is seriously contaminated, so much so in fact that I doubt as to whether the fry would live in the streams. This contamination, I am confident, is caused by the various manufacturing plants located along said streams, discharging sewage and other waste water into the streams. Before I go any further in the matter of bringing the question of stocking the streams to the attention of the Forest, Fish and Game Commission, I naturally must know if anything can be done to relieve the character of the water; I would like very much to know through your Department whether or not the various manufacturing plants situate along the Hudson river to the village of Schuylerville, Saratoga county, also the concerns located on the Hoosick river from a point where the Hoosick enters the Hudson thence up to the town of Hoosick, Rensselaer county, have permits from your Department covering the discharge of sewage into these rivers, also whether they are discharging to an unlawful extent.

The water in the Hudson river which has to pass my residence in North Troy, formerly Lansingburg, is filthy in condition, and this summer, owing to the drought has, I am sure, proved a menace to the health of our community.

If an officer from your Department could make an examination of the conditions which ought to be improved, by visiting the manufacturing plants in the territory above mentioned and reporting the result of his examination I am confident it would bring to light conditions which could be improved. At any rate such a visit to these plants would at least act as a restraint to the further abuse of the privileges now extended by your Department.

Awaiting your reply, I remain,

Very truly yours,

F. C. FILLEY

ALBANY, N. Y., *October* 11, 1906.

HON. FREDERICK C. FILLEY, *Member of Assembly, Troy, N. Y.*

DEAR SIR:— I have yours of October 9th and note what you say regarding the pollution of the streams which it is desired to stock with fish.

There are undoubtedly a large number of manufacturing establishments along the Hudson and Mohawk rivers and their tributaries, discharging sewage and various forms of mill waste into these waters without permission from this Department and in direct violation of the law relating to the protection of the waters of this State from contamination.

This act was passed in 1903, since which time the Department, with the limited means at its disposal for work of this kind, has been endeavoring, so far as possible, to prevent any further pollution of the waters of this State, more particularly those waters used as potable water supplies by various municipalities, and this question involves not only the prevention of the discharge from cities but also the control of the large manufacturing establishments many of which discharge chemicals and other injurious substances into our rivers.

You can readily understand that questions of this character involve considerable study and that there is a large amount of work involved in making a careful and thorough inspection of a stream in order to note carefully the amount and nature of the refuse which it receives.

The conditions of which you complain will receive our careful consideration and one of our inspectors will in a short time make a careful examination of the conditons and you may be sure that this Department will do all that lies in its power to prevent any further serious contamination of the water. I will be glad to take the matter up with you as soon as the report of the conditions there is received, and to go over it with you carefully should you so desire.

Very truly yours,
A. H. SEYMOUR,
Secretary

In accordance with the foregoing an investigation of the pollution of the Upper Hudson river and tributaries was made by Mr. H. B. Cleveland, Assistant Sanitary Engineer, between November 8 and December 15, 1906.

Information collected at that time was incorporated in the report on the pollution of the Upper Hudson made to Governor Hughes in accordance with an executive order dated May 17, 1907, and published elsewhere in this volume.

Following is the letter of transmittal directed to Hon. F. C. Filley, accompanying the report of the earlier investigation.

ALBANY, N. Y., *April* 8, 1907.

HON. FREDERICK C. FILLEY, *Member of Assembly, Albany, N. Y.*

DEAR SIR:—I inclose herewith a report upon an investigation of the pollution of the Upper Hudson and Hoosick rivers, which has just been completed by our Division of Sanitary Engineering, in accordance with the request contained in your letter of October 9, 1906.

I regret exceedingly that this investigation and report have not been completed and transmitted to you at an earlier date. You will readily understand, however, that with questions of this character not only is a large amount of detail work involved, but considerable field work of a time-consuming nature. It has also happened that during the past season there has been an unusually large amount of regular and special work of a pressing nature that has occupied the attention of the Sanitary Engineering Division.

Before your request was made to me last October, the Sanitary Engineering Division had under way investigations similar to the present one, covering the watersheds of the Oswego and Susquehanna rivers. A similar investigation for the watershed of the Hudson river was at that time contemplated, and it is still my purpose to extend the studies now partially completed for this watershed, as embodied in the accompanying report, to include the entire drainage basin of the Hudson river. The inclosed report, then, while not a complete one as to extent of territory, has, I believe, been carried out in sufficient detail to serve your purposes. It will, in fact, eventually form a part of the final report for the entire Hudson river basin.

The report is, of necessity, essentially statistical. It gives both in detail and in summarized form the character and amounts of pollution that enter the Hudson and Hoosick rivers. In addition to the pollution by industrial plants, there is also given a comparison of the municipal or domestic sewage that is discharged into these sewers at various points along the Hudson river above its junction with the Mohawk river.

Of the industrial plants that now discharge their wastes into these rivers, many have not complied with the 1903 act, which required that reports be filed with the Department within sixty days from the date of the passage of the act. Many of these plants were in existence, however, prior to the passage of this act, and were, therefore, exempt from the provisions thereof. Some, however, have been established since the passage of this act, and since these are the principal violators especial attention has been and is being taken with regard to them.

With the limited means and engineering force that has been available for making investigations of this nature, it has been difficult, if not practically impossible, to secure a list of the industrial plants that are violating the 1903 law. This work has been well started, however, since the reorganization of the Sanitary Engineering Division last year, and it is now hoped, if the additional appropriation asked from the present Legislature for this important branch of the Health Department is made available, that greater progress will be made in not only locating but prosecuting these violations.

Only recently have general notices been sent to a large number of municipalities and industrial establishments calling for reports, as required by the 1903 law. It is, in fact, my intention to follow these up with others as fast as systematic inspections can be made to reveal these violations.

Unfortunately the statutes, with respect to pollution, and more especially that of industrial pollution, although imposing certain duties upon the Health Commissioner, and certain powers of preventing pollution subsequent to 1903, do not carry with them executive authority to enable him to peremptorily remove pollution that existed prior to the passage of this act. This peremptory authority should, of course, properly be vested in the State Health Commissioner, but without it he must, in cases of pollution that existed prior to 1903, rely upon powers of an educational or persuasive character. This power, I can assure you, will be exerted in the case of the Hudson and Hoosick rivers. It can, of course, be more effectively done when the present investigation of the entire Hudson has been covered and a definite policy and line of action has been decided upon.

In the meantime I hope that the present investigation and report will be of assistance to you. If there are any points referred to in the report that I can further explain to you, or any additional information that I can give you in this matter, I should be pleased to do so.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

LAKE GEORGE

ALBANY, N. Y., *August* 9, 1907.

HON. W. S. JACKSON, *Attorney-General, Albany, N. Y.*

DEAR SIR:— During this year this Department has been engaged in the investigation of the conditions at certain summer resorts, etc., and in this investigation the conditions of Lake George have received considerable attention. During the visits of our inspectors to the various resorts on Lake George, complaints have been received with reference to the steamboats on the lake, dumping ashes and discharging their refuse, sewage, etc., into the waters of the lake. We have, therefore, included this subject in our investigation and have confirmed these complaints.

Up to a short time ago, the steamboats discharged their ashes, sewage, etc., directly into the lake, but I have been advised — though not officially — that a number of indictments have been found against the Lake George Steamboat Company for dumping ashes and sweepings into the lake and that they have since installed a method whereby they have discontinued this practice. There is no doubt, however, that the sewage from the boats operated by the Lake George Steamboat Company, viz., the Horicon, Sagamore, etc., is discharged from these boats directly into the lake and that they carry a very large number of passengers during the season. I took this matter up directly with the Lake George Steamboat Company, which has its general offices at Burlington, Vt., and have been in correspondence with them with reference to discontinuing the discharge of this sewage. They have advised me that the matter is receiving some consideration, but, failing to receive any assurance from them that they propose to even begin experiments as to the best manner of abating the condition, I am placing this matter in your hands for attention.

The waters of Lake George are used as potable water supply by a large number of people during the season and should be preserved as far as possible in their natural purity. The discharge of sewage from these boats is undoubtedly a direct violation of section 52 of chapter 592 of the Laws of 1897, as amended by chapter 378 of the Laws of 1901, which provides as follows "No person or persons shall drain, deposit or cast any dead animal, carrion, offal, excrement or garbage or other putrid or offensive matter in the waters of Lake George." As the practice of the Lake George Steamboat Company is evidently a direct violation of the provision of law referred to, the matter is respectfully referred to you for your consideration and such action as may appear to be necessary. The Department is prepared to furnish you with the evidence of our inspectors, showing that the sewage is discharged directly into the lake, or we will procure any additional evidence that you may desire, and I will be glad to furnish you with copies of all the correspondence if you require them.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *August* 13, 1907.

Hon. EUGENE H. PORTER, *Commissioner of Health, Albany, N. Y.*

DEAR SIR:— Replying to yours of the 9th inst., *In re* Lake George Navigation Company: You state that the above company is permitting offal, excrement, etc., to be discharged from its passenger boats which ply on Lake George and you request this Department to take such action as may be proper, and you refer to section 52 of the Navigation Law, as amended by chapter 378 of the Laws of 1901. The above section reads as follows:

"No person or persons shall drain, deposit or cast any dead animal, carrion, offal, excrement, garbage or other putrid or offensive matter in the waters of Lake George or Schroon lake in this state; or moor or store logs or rafts in any bay or inlet to such lakes. This section shall not be construed to prevent the deposit of the usual waste or drainage from factories, or the storage of logs or rafts by adjacent owners in front of their own uplands, or the rafting or floating of logs through Schroon lake in the usual manner, or the erection of booms prior to the 20th day of June in each year to secure and prevent the separation of logs in such lake for such time as is required to float them through the outlet in such manner as not to interfere with its navigation by any party employing steamboats to carry freight or passengers. Logs or timber or lumber of any kind shall not be rafted or floated through the waters of Lake George at any time from the first day of July until the first day of October of any year. Every person violating any provision of this section shall forfeit to the town where the violation occurred the sum of one hundred dollars for every such violation."

The Town Law provides, section 22:

"The electors of each town may, at their biennial town meeting:

"3. Direct the prosecution or defense of all actions or proceedings in which their town is interested."

The Town Law also provides, section 80:

"The supervisor of each town shall:

"2. Prosecute in the name of his town for all penalties given by law to such town for its use and for which no other officer is especially directed to prosecute."

The Town Law further provides, section 180:

"The following shall be deemed town charges:

"7. The costs and expenses lawfully incurred by any town officer in prosecuting * * * any action or proceeding brought by * * * the town or such officer, shall be a town charge in all cases where the officer is required by law to so prosecute * * * or is instructed to so prosecute * * * by a resolution duly adopted by the town board or at a town meeting duly held * * *."

In view of the foregoing provisions of the statutes, this Department has no authority or duty in bringing suit for the penalties provided by the Navigation Law, above referred to, but I advise you to communicate your information to the various towns bordering Lake George for whose benefit the penalties are imposed and whose officers are empowered to bring the necessary suits.

Yours truly,

W. S. JACKSON,

Attorney-General.

ALBANY, N. Y., *August* 19, 1907.

Mr. HENRY W. HAYDEN, 120 *Broadway, New York City*

DEAR SIR:— I beg to inclose you herewith copy of the opinion of the Attorney-General with reference to the Lake George Navigation Company.

You will remember that I wrote you a short time ago, stating that I had sent this case to the Attorney-General, and he now advises me, as you will see by reference to the inclosed decision, that his Department has no authority or duty to bring the suit; that responsibility evidently rests with the various towns bordering on Lake George, whose officers are empowered to bring the necessary suits.

Before attempting to send copies of this decision to the town officials, I thought I had better consult with you regarding it. If you will advise me as to which towns you think would be apt to take up this matter I would be very glad to send them copies of this decision and bring the matter to their attention.

I note from your recent letter to Dr. Porter that the new steamer is to be equipped with sewage disposal plant.

As the Lake George Protective Association is the principal complainant in this case, I would be glad to have you advise me as to what towns about the lake the matter had better be brought before.

Very truly yours,

A. H. SEYMOUR,

Secretary

On September 9th a letter was addressed to the supervisors of the towns of Bolton Landing, Hague, Ticonderoga, Putnam, Clemons, Fort Ann, and Glens Falls, inclosing a copy of the opinion of the Attorney-General.

MONTOUR FALLS

In the Twenty-seventh Annual Report of the Department, correspondence relating to the nuisance existing in Montour Falls is presented. Complaints were received during 1907 of the continued existence of this nuisance.

The matter was again investigated and the General Pneumatic Tool Company advised to construct a sedimentation and screening plant. This work was undertaken during the latter part of the year.

ONEIDA

ONEIDA, N. Y., *June* 11, 1907.

State Department of Health, Albany, N. Y.:

GENTLEMEN:— After repeated efforts last year to have the State feeder cleaned "running through Oneida," I referred the matter to the State Department of Health. A representative was sent here, who looked the matter over following which, notice was served by the State to every owner of property abutting on said feeder, no attention was paid to this whatever. Again this spring, by order of the board of health of this city, I served notice on every owner of property, no action was taken by this request. At a meeting of the board of health last night I was requested to again notify the State Department of Health of the bad condition of things, and inform you of the neglect or refusal to comply with any request I have made, and again asking your assistance in the matter.

Very sincerely yours,

A. P. DODGE,
Health Officer

ALBANY, N. Y., *July* 19, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany,*
N. Y.

DEAR SIR:— I have the honor to report that on Friday, July 19, 1907, in response to a telegram from Dr. A. P. Dodge, health officer of the city of Oneida, I visited that city and found the condition as follows:

The Oneida feeder of the Erie canal runs directly through the business portion of the city, across and under the main street, under and back of the stores, and, above the business section, alongside a principal residence street, and below the business section, along the main highway leading north. This feeder is the receptacle of a large amount of refuse from the city, some of it unavoidable and some of it unnecessary and readily preventible, but all more or less organic in nature. This pollution of the feeder has continued for a number of years in gradually increasing amounts since the feeder was last cleaned, said to have been done by the Department of Public Works as a part of their regular care of the canal appurtenances, and at a time now some seven years since. Directly after that cleaning and removal of refuse, it is stated that the authorities were active, individual and civic pride was aroused and little or no refuse was thrown into the water. But gradually, one by one, individuals have become indifferent and the channel is today the evident dumping ground for garbage of all sorts. One large drain is visible, entering from the west formerly laid as a surface drain. From the character of the discharge, it is entered at some point by a house drain and discharges sink and laundry water, if not actual water closet discharges. The city has a system of sewers, and except for this case it is believed that no domestic fixtures discharging through house sewers enter the feeder, but rather that the pollution comes from slops, garbage of all sorts, and similar refuse thrown in directly. Tin cans are visible in abundance. Old broken boxes, clam shells, pea pods, wash of spittoons, old papers, etc., are to be seen throughout the distance of about one-half mile, where the feeder is convenient to the rear of the stores and office buildings. The general impression obtained from looking at the exposed bottom of the channel is that it has become the garbage dump of all the houses and stores within reaching distance.

The feeder, ten to fifteen feet wide, runs between stone walls through the business section of the city and the water is said to be generally about three feet deep. At the present time, the upper gates have been closed to allow certain contractors to construct some masonry walls in connection with the canal improvement and the feeder stands partially dry and will so stand for about six weeks more. The stagnant water, left in pools on account of the uneven surface of the feeder bottom, caused undoubtedly largely by the deposit of refuse, makes a condition of things which seems to the local health officer very alarming. He reported the matter of garbage dumping and the resultant odors to the Department a year ago, and certain orders were issued and served on abutting property owners to remove the garbage from that part of the feeder adjoining their premises, of the present existence of a public nuisance and of an imminent menace to the public health, conditions which should be remedied at once in anticipation of further hot weather. Complaints of the residents in the vicinity have already become loud and continuous, but each disclaims direct responsibility.

The problem in my opinion is one which has come up before and will doubtless come up again, and it should be brought to an issue and fairly answered, viz.: How and where is the responsibility for the polluted condition of State waters, whether canals, feeders, ditches, or drains to be fixed? Cities and villages discharge into the canals, in fact it has been the common point of discharge of most of the small village sewers in the western part of the State. Newark Custodial Asylum, a State institution, runs the sewage of 600 persons directly into the canal. The drain along the Erie canal in the western edge of the city of Rochester is entered by many house sewers, and the State drain has seriously polluted a small stream into which it discharges. A State drain in the bottom of the abandoned canal at Montour Falls is used as a sewer by a number of residents, and thus contaminated water is carried into the State dredged channel near the mouth of which Watkins takes its water supply.

Other examples might be given, but the meaning of the question as stated above should be clear. It would be easy, and in many cases entirely justifiable for adjoining property owners to disclaim, first any ownership in the property of the State; second, any responsibility for a stagnant pool in a canal, the waters of which had been drawn off by direction of the Department of Public Works; third, any obligation in law or equity, by which they should be made to remove debris which has been carried by the current and lodged before their property.

I venture to suggest, therefore, that the matter be taken up at once with the Department of Public Works, and if possible that that department be led to accept the fact that in the case of the Oneida feeder, and in similar cases where the nuisance is clearly on State land, in connection with insanitary conditions found in State waters, which the State, through its Department of Public Works has allowed to exist, and where there is no direct evidence of the source of the contamination, that the Department of Public Works is responsible for the conditions, and on the certificate of the Department of Health as to the existence of a nuisance shall promptly remedy the same.

This should not preclude, in my opinion, such assistance as may be given by the Department of Health and where local evidence of direct pollution exists, the power of injunction and assessment under the Public Health Law should be promptly invoked, and so far as that method of assistance goes, be placed at the disposal of the Department of Public Works. But in my opinion the responsibility for the continued pollution and contamination of the Oneida feeder belongs to the State officials in charge of that water, and that they should at once be called on to do away with the nuisance for which they are responsible.

Respectfully submitted.

HENRY N. OGDEN,
Assistant Sanitary Engineer

ALBANY, N. Y., *July* 25, 1907.

Dr. A. P. DODGE, *Health Officer, Oneida, N. Y.:*

DEAR SIR:— One of our engineers has reported with reference to the sanitary conditions existing in the village of Oneida which he inspected some few days ago. It appears from his report which recites fully the conditions existing there, that the Oneida feeder of the Erie canal has been the receptacle of a large amount of refuse and that the conditions existing there at the present time are very insanitary.

Upon the receipt of his report I took this matter up with the Superintendent of Public Works, and I am today advised by him in part as follows:

"The conditions complained of are entirely of Oneida's own making, and for these conditions the local board of health of Oneida is very largely, to my mind, responsible. The putrid matter that has found its way into the Oneida feeder at Oneida has been placed there in violation of orders given by this Department. These orders, citing the provisions of the Penal Code with reference to such matters were not only served upon the property owners adjacent to the feeder, but a copy of such orders was served upon the local board of health of Oneida.

"I do not feel that the State is in any way responsible for the condition, and therefore I do not feel that this Department should be called upon to give relief. It is undoubtedly true that the condition just at present is made somewhat worse by reason of the fact that it has been found necessary to stop feeding through this feeder because of certain contract work which is being progressed in the city of Oneida. This contract work consists of the construction of a retaining wall, and while it is being done at State expense, it is solely in the nature of a local improvement."

You will note from the communication of the Superintendent of Public Works that he does not feel that the State is responsible for the condition, nor that his Department should be called upon to give relief. Undoubtedly, action by your board of health to prevent refuse and sewage from being thrown into the feeder would have prevented the condition which now exists, and I would suggest in view of the attitude of the Superintendent, that immediate steps be taken by your board of health to prevent such a condition in the future. The condition is apparently one which should be remedied at once, and the board of health should act without delay, and under the circumstances it does not appear that any other relief is to be obtained. I trust that your board of health will take prompt and energetic action in the matter not only to remedy the present conditions, but to prevent a repetition of the same in the future.

I will be glad to have you advise me as to the action which is taken.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

SYLVAN BEACH

ALBANY, N. Y., *July* 20, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.*.

DEAR SIR:— I have to report that, on account of a complaint, made by Mr. H. L. Rexford, of the insanitary conditions existing at Sylvan Beach, I visited the place on Friday, July 19th, and investigated the alleged nuisances. The complaint alleges that the public privy and some of the hotels sewer into the lake or into the creek at its mouth, and that much refuse is thrown into the creek.

I was unfortunately not able to see the president of the village, Dr. Cavana, nor the health officer, Dr. Bacon, who were both out of town, but made a careful personal inspection of the village with Mr. Bryant, chief of police accompanying me, and I particularly noted the condition of the beach from the north end of Sylvan Beach to the cottage owned by Mr. Rexford at the south end of Verona Beach, a distance of about two miles. I inspected the public privy and inspected some of the garbage cans at some of the hotels, and in other ways made as complete an inspection [illegible] the time permitted.

Sylvan Beach is a popular summer resort, the Mecca for day excursionists from Utica, Syracuse, and other points reached by the New York Central and Lehigh Valley railroads. The bathing beach is probably the chief attraction, although there is also an amusement pavilion and many booths for lunches, etc. Under such conditions it is possible that the immediate result of a large visitation of excursionists may be some conditions which would not be tolerated in a more settled community. But I am convinced that the authorities make every effort to keep the grounds in good order and to avoid any conditions which may be prejudicial to health. A man is delegated to keep the public privy clean, and it is regularly washed out each day. The garbage from hotels and cottages is collected daily and carted away. I saw no evidence of any sewage being discharged into the waters of Fish creek, although I was informed that the Forest Park hotel did so discharge. The waters of this creek are now much discolored from the work of the contractors on the barge canal, who are excavating a channel a short distance away. The public privy is said to discharge into a cesspool and the cottages are said to be all provided with cesspools. If any sewers do discharge into the mouth of Fish creek they will doubtless be uncovered during the work of construction of the barge canal, which is to utilize the lower part of this creek, and then will be ordered disconnected.

The police force are instructed to enforce the sanitary regulations of the village, and I learned of two offenders, local residents, who had recently been fined for the insanitary condition of their private privies.

I am of the opinion, therefore, that considering the character of the place, the local officers charged with the maintenance of public health are active and thoroughly awake to the sanitary needs of the village, and that a complaint of any temporary nuisance should be referred to them with every confidence that it will be properly acted upon.

Respectfully submitted,

HENRY N. OGDEN,

Assistant Sanitary Engineer

TROY

TROY, N. Y., *May* 22, 1907.

Dr. E. H. PORTER, *New York State Health Commissioner,*
Albany, N. Y.

DEAR SIR:— Having seen in the papers of your appointment by Governor Hughes to make an investigation of the pollution of the Hudson river, I would respectfully call your attention to the fact that the Troy Gas Company of Troy, N. Y., do and have done for years past, sewer from their works above the State dam, Troy, N. Y., into the Hudson river, polluting the water to such an extent that any boat or any vessel left in the vicinity any length of time, will be coated with oil or tar, and must be the cause of the disappearing of the fish from the water in that vicinity, or that part of the Hudson river.

Respectfully yours,
B. COOPER ICE & COAL CO.

ALBANY, N. Y., *August* 16 ,1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.

DEAR SIR:— I beg to report that on August 14th, at your request, I visited the plant of the Troy Gas Company, located at the foot of Smith avenue on the left bank of the Hudson river in the city of Troy, and inspected the plant with respect to the discharge of wastes into the river, complaint having been received at this Department of the pollution of the river by tar and oil discharged from the gas works.

The product of the plant is from 700,000 to 800,000 cubic feet of water gas daily. Three sets of gas making apparatus are used alternately as required, each set consisting of a generator, a carburetter and a superheater, all made up of steel cylinders.

The coal, anthracite coal being used, is placed in the generator and live steam is passed upward through the coal under twenty-four inches of water pressure. The vapor formed when the steam disintegrates the coal and which acts as the base for the gas is then passed downward through the carburetter under a high temperature. During its passage through the carburetter the coal vapor or water gas combines with oil gas which is formed as crude oil is sprayed into the heated carburetter.

From the carburetter the gas mixture is passed upward through a superheater, which like the carburetter is stacked with brick laid loosely and with about 50 per cent. joints. The temperature in the superheater is about 1,600 degrees Fahrenheit and in this cylinder the gas is made stable.

Passing from the superheater the cooling of the gas down to 80 degrees Fahrenheit is effected by spraying the gas with water during its passage through a large 16-inch pipe to a water valve near the superheater. This cooling, of course, produces condensation and a precipitation of tar and some of the lighter hydrocarbons. The tar and lost oil passes off by reason of the overflow of the water valve and at this point occurs the first waste in the process. The overflow from the water valve is conducted to the settling basin which will be described later.

After passing through the water valve, near the superheater, the gas is next passed through wet scrubber condensers during which the greatest waste of the process occurs. The gas is passed downward through one large steel cylinder and upward through another. In the cylinders water sprays are operated and considerable precipitation of tar and lighter hydrocarbons takes place. The wastes from these wet scrubber cylinders is also conducted to the settling tanks hereafter described.

From the scrubbers the gas is passed to a large cushion tank or holder outside the building used to equalize the flow since the gas is manufactured in batches, one every eight minutes, and during the further processes of refining necessary, a uniform flow is essential.

From the cushion tank the gas is passed through purifier beds consisting of pine shavings mixed and coated with iron filing and dust.

The gas is then stored in the holding tanks ready for distribution after having been passed through condensers made up by an arrangement of water tubing in a steel cylinder similar to a water tube boiler. In these condensers the gas does not come in contact with the water and there is therefore no waste but the pure tar which is valuable and is saved.

As to the present disposition of the wastes:

The water which has come in contact with the gas both from the water valve and from the wet scrubber condensers, is conducted to three circular steel vats or settling tanks, twenty feet in diameter and five feet deep, arranged in series so that all the waste flows through the three tanks before being discharged into the river.

In the first two tanks seven parallel partitions are placed about three feet apart, openings being left on alternate partitions at the sides of the tank so that the length of flow through the tank is increased as much as possible to allow for the greatest precipitation of the tar and dirt or ashes carried with the gas.

The capacity of the three settling tanks is about 35,000 gallons.

The superintendent stated that as nearly as could be estimated, the average quantity of water used in the process, exclusive of that used in the boilers and including the water sprayed into the wet scrubbing condensers and into the pipe leading to the water valve, amounted to about 50,000 gallons daily. There would be, therefore, an average detention of sixteen or seventeen hours in the settling tanks and this should afford ample time to settle out the heavy tar. Between each partition in the first two tanks and attached to a swinging arm in the third tank are suction pipes connected to a suction main through which the tar which settles in the tanks is pumped, twice a week, to a storage tank at the plant.

At the time of the inspection, the settling tanks seemed to be operating very satisfactorily. Comparatively little oil and tar was noticeable on the river surface and bank below the point of discharge. The effluent from the tanks, although containing comparatively little tar and oil, was reddish in color and appeared roiled. This was probably due in part to iron oxides carried by the condensation water from the purifier beds and in part to ashes and dirt taken up from the coal and carried by the gas.

The influence on the river of the discharge from the settling tanks appears to be practically lost at a point only a few hundred feet down stream except for the oil on the surface, a little of which, it may be said, "goes a great way." It is possible that the accumulation of oil and the tar which does escape at present causes some slight damage to manufacturing interests and annoyance to fishing, boating and bathing at points down stream from the plant.

In view of the improvements which are now being carried on at the gas works, no inquiry was made to obtain evidence as to the effect of the tar and oil on manufacturing, boating, etc., it being believed that the improvements under way would practically remove any nuisance which may exist.

A new water tube condenser is being constructed at the plant similar to the small one now in use at the cushion holder. The gas from the superheater and water valve, on the completion of the new condenser sometime within a week, will pass through the two cylinders now used as wet scrubber condensers but which will then be used only as air cooled condensers; the gas will then pass to the new water tube condenser and then to the cushion holder as before described. There is, therefore, to be no water contact with the gas at any point when the new condenser is operated except at the water valve and the pipe leading to the water valve. The superintendent stated that by this improvement about 90 per cent. of the water used at present would be saved, since only about 10 per cent. of the total water used is used in the water valve. This improvement in having less water come in contact with the gas, while it may not effect 90 per cent. decrease of waste by reason of the fact that the precipitation from the condensation is undoubtedly greater in proportion in the water valve and the pipe leading to it than in the wet scrubber condensers, still a very decided betterment of conditions will result and I would recommend that the matter be held in abeyance, pending further complaints, if any such complaints are received after the use of the added apparatus.

Superintendent Horton, of the B. Cooper Ice and Coal Company, whose plant is located on the river bank one block upstream from the gas plant, stated that in the winter season when the river was covered with ice, the discharge of the warm, oil laden water from the gas works at the surface elevation of the river, kept the ice melted and when a thaw occurred so that the water spread over the ice and a south wind arose, the oil was blown up the river over the cutting fields opposite the ice plant.

If, in the future, this especial cause for complaint is not removed by reason of the improved condensation methods which are to be adopted at the gas plant, the inconvenience to the ice company caused by the oil on the surface might be done away with if the gas company were required to extend the settling tank outlet pipe from the edge of the bank to a point out in the river so that the discharge would be well under the water surface.

The officers of the Troy Gas Company are as follows:

President, Edward Murphy, 2d; Secretary, Charles E. Davenport; Superintendent and Engineer, H. C. Shields.

Respectfully submitted,

H. B. CLEVELAND,

Assistant Sanitary Engineer

WHITE PLAINS

Complaints were received in May of the discharge of sewage into a small stream at the foot of Lenox avenue in White Plains.

An inspection was made of the conditions and a communication was addressed to the board of sewer commissioners of White Plains, urging them to at once take up the consideration of the matter involved, viz.: The construction of a trunk or outlet sewer northerly from Lenox avenue down the valley to the Kensico avenue sewer to serve as an outlet for the Lenox avenue sewer, and such other sewers as may in the future be constructed in streets crossing this valley.

INVESTIGATIONS OF PUBLIC NUISANCES

NOT

ARISING FROM STREAM POLLUTION

INVESTIGATIONS OF PUBLIC NUISANCES NOT ARISING FROM STREAM POLLUTION

ALLEGANY

Complaints of the unsanitary conditions along the Erie Railroad, in the village of Allegany, were received from the health officer and on June 10th an inspection was made of local conditions.

The board of health was directed to convene and take the necessary action to prevent the discharge of all domestic sewage and other organic waste into the railroad ditch, and also suggesting that the board notify the Erie Railroad Company to repair and [illegible] [illegible] of the waters from [illegible].

AUBURN

[illegible]

ALBANY, N. Y., *December* 28, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.*

DEAR SIR:— I beg to transmit herewith the report of Prof. H. N. Ogden, Special Assistant Engineer, upon his inspection of the sanitary conditions of Cayuga county jail. The report covers the ground fully and the conclusions reached in regard to the improvements needed at this jail I fully concur with.

Respectfully yours,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 28, 1907.

MR. THEODORE HORTON, *Chief Engineer, State Department of Health, Albany, N. Y.*

DEAR SIR:— In accordance with your instructions, I visited the Cayuga county jail on December 26, 1907, and have the honor to report as to its sanitary condition as follows:

From measurements made at the time of my visit, I have drawn floor plans of the three stories of the building used for the sheriff's residence and for the jail and in the following description and report reference will be made to these plans. The "cage" or rear part of the building is built of limestone, the rest of the building of brick. It has the appearance of a new building and is throughout, as far as could be seen, in good structural condition.

General Arrangements

A corridor, eight feet wide, shown on all the plans, separates the "cage" from the rest of the building. About one-half of the second story and the entire floor of the third story have been divided up into compartments and provided with blocks of cells. There are on the second floor one such block of five cells for "debtors;" on the third floor are three such blocks, one of three cells for condemned prisoners, one of four cells for boys and "trusties" and one of six cells for women. The "cage" contains twenty-eight cells, in two rows and in two tiers, with seven cells in each tier.

Tabulated the capacity of the prison is as follows, each cell containing a single berth intended for one person:

	Cells
Cage	28
Debtors	5
Condemned	3
Boys and trusties	4
Women	6
Total	46

The twelfth annual report of the State Commission of Prisons gives the highest number of prisoners at any one time during the year 1906 as 60, the lowest as 35 and the average at about 38. I was informed that there had been in years past as many as 85 confined in the jail on one day. The extra accommodations needed were obtained by putting mattresses on the floors of the corridors and even on the floors of the cells but it is evident that in view of the necessity for classification and in view of the restrictions on the use of the women's cells and of the "condemned" cells that the maximum accommodation to be properly had in the jail is about 40. If a larger number of prisoners than this are to be cared for even temporarily, the jail is too small.

"The Cage"

The "cage" occupies the stone portion of the jail building. The inside dimensions are about 43 by 44 by 22 feet high up to the eaves. A corridor of three feet width is left on three sides and one of five feet width on the fourth side, so that the steel cage which sets in this stone room is 35 by 38 by 16 feet high. The bottom, sides and back end of the cage are of steel plates, the front end and the top being of steel flats, two inches wide, spaced to make openings two inches square. On the two sides of the cage, facing each other are the rows of cells, each 5 by 8 by 8 feet high, approach to the upper row being had by means of steps leading up to a narrow gallery.

Light for the cage comes from a skylight in the roof, about 500 square feet of the central part of the roof being ground glass. Light can penetrate the cells only from the front and the back part of the cells is very dark. When the cell doors are shut, the light can enter only through the openings in the door grating which amounts to 10 square feet out of the 60 square feet of door or about 16 per cent. Such conditions of semi-darkness make it difficult to keep the back part of the cells clean and encourage a condition of filth which would be largely obviated if light could reach every corner of the cell.

Every cell is provided with a washbowl, with running water and a water closet, the latter flushed by direct pressure from the city mains. These fixtures are at the back end of the cells, the closet being in the shadow of the bed so that it loses what little light might get through the door. These fixtures are of cast iron, more or less rusty and corroded, and contribute a certain amount of odor to the atmosphere of the cell. The plumbing of these fixtures is carried out through the steel walls into the corridor where they are available for repairs.

From the bottom of each cell, in each tier, a three-inch galvanized duct is led up on the back of the cells into six-inch headers which discharge into two twelve-inch ventilating flues opening into the outer air above the roof. The main drains on each side are also carried up through the roof, but are so reduced in size and are given so many angles that it is not likely that any efficient ventilation of the soil pipe is secured.

There are no sheets or pillow cases provided but it was said that each prisoner on entering was given newly-cleaned ticks filled with new clean straw. All the prisoners were at liberty inside the cage and were generally engaged at card-playing at the table provided.

Ventilation

The cubic contents of the "cage" is 21,280 cubic feet, or for twenty-eight persons, 760 cubic feet of air per person. This amount of cubic space corresponds to that recommended by eminent prison authorities, Howard commending a range between 360 and 1,400, Parkes considering 600 sufficient, when supplemented by mechanical contrivances, Morin advising 600 to 700, and Corfield giving 750 to 1,000 cubic feet. The British army regulations allow 600 cubic feet per head. In all cases it is assumed, however, that proper means are provided for changing the air in this space. The means provided for the purpose in the Cayuga county jail are altogether inadequate. In the floor of the cage are two perforated plates, each containing about 360 one-half inch holes or nearly four square feet in all. Besides these perforated plates inside the cage, there are six more in the corridors just outside, three on each side, these containing 170 half-inch holes or a total area of 5.5 square feet. These perforated plates are supposed to obtain air from the basement which extends under the cage and which is used as a weaving-room. On the north side of this basement are five area-way windows, 28 by 48 inches. On the east end are two of the same size and on the south side are three windows, 24 by 30 inches. The perforated plates in the corridor directly adjoin the windows so that with the windows down from the tops, direct access through the plates may be had for the air to reach the room above. On the day of my visit, however, two men were weaving in this basement and all the windows were closed tightly.

The amount of fresh air that ought to be supplied in order to avoid the dangers due to exhalations of the prisoners and to the emanations of organic matter from their bodies and clothes is variously estimated at from 1,500 to 3,000 cubic feet per hour or from 25 to 50 cubic feet per minute. For 28 men this means, even at the lower figure, 700 cubic feet per minute. If this be assumed to be passing through all the plates with their combined area of 9.5 square feet, the velocity of the air would be over one foot per second, entirely impossible without some artificial method of ventilation. Or if the air in the cell, 320 cubic feet be assumed to be changed by passing out through the three-inch galvanized pipe, with a velocity of two feet per second, the air would be changed but once an hour, entirely inadequate for healthy conditions of life. As a matter of fact, no such velocity is obtained and cannot be under the arrangements which obtain. It is almost certain, indeed, that since any movement of air through these pipes is due only to atmospheric and barometric changes, that at times there is an entire stagnation in these pipes and no ventilation at all takes place.

Moreover, even if there should be a free passage of fresh air through the corridor ventilators, it would have but little effect on the inside part of the cage where the men are confined and none at all in the inside of the cells. The air would enter the corridor from the basement and pass out at the roof without improving the condition of the prisoners.

Water

The prison is supplied with an abundance of good water from the city system. A small washbowl is provided in each cell and there is one outside the cells at the back of the corridor. Tub baths are provided for each block of cells, as shown on the plans. I was informed that the prisoners are required to bathe whenever the necessity is apparent.

The sewage is collected by properly arranged interior plumbing and is discharged into the city sewerage system.

Heat

The prison is warmed throughout by steam heat by direct radiation, the radiators being placed directly in the cage, as well as in the corridors. No advantage is taken in the heating to improve the ventilation and apparently the only concern is to have the temperature sufficiently high.

Exercise

The only exercise permitted the prisoners is taken in the central corridor in front of the cells, no outdoor yard being available.

In general the statements already made will apply also to the other parts of the prison.

Debtors' Prison

The debtors' prison is 44 by 24 by 9 feet high, containing six cells, although on occasion more men are placed in this room. Six men would have about 1,600 cubic feet of air each, but from lack of ventilation the air of this room seemed more foul than that of the cage. The three windows were all tightly closed, except for about an inch at the top of one of the windows. Galvanized iron pipes, four inches in diameter, were carried out from each cell as before, but from the top instead of from the bottom. The windows being opposite the cells, made these the lightest cells of the whole prison.

" Condemned " Cells

The " condemned " cells contained only one prisoner, and the air seemed pure and good. The volume of air space is about 2,925 cubic feet, or nearly 1,000 cubic feet per man with three men in these cells.

The cells are vented from the top by galvanized iron pipes, as before, and the pipes are exposed in a dark passage between these and the next block of cells.

Boys and " Trusties "

The rooms for boys and " trusties " had no one in at the time of my visit. It contains 6,300 cubic feet of air space, or nearly 1,600 cubic feet of air per capitum with four men in the cells. I was told that cots were frequently placed in the room to accommodate an excess of prisoners and at such times it undoubtedly becomes overcrowded. It is hardly available, however, for general use, since the windows are not barred and only the gentlest prisoners could be kept here unless locked up in the cells.

Women's Cells

The women's ward contains about 6,930 cubic feet of space, or 1,150 cubic feet per capitum when fully occupied. This room, like the last, can probably be satisfactorily ventilated by the adjustment of the windows which are ample in number and size for this purpose. Vent pipes are provided, I was told, for the egress of vitiated air from the cells, which latter face the windows and are, therefore, not as dark as the cells in the cage.

Summary

1. The water supply and the sewerage systems are connected with the city systems and are adequate and suitable.

2. The plumbing fixtures in the cells are of cast iron, are corroded, and are in such a condition as to cause particles of organic matter to adhere and, in decomposing, to add to the pollution of the atmosphere.

3. The direct system of heating, while economical, is not suitable for delivering freshly-warmed air into the cells, but it only warms over and over the vitiated air.

4. The light entering the cells of the "cage" and the "condemned" cells is entirely inadequate, partly on account of the arrangement of the cell and partly on account of the small open space (16 per cent.) of the steel grating.

5. The bedding is not protected by sheets and pillow cases, but comes in direct contact with the prisoners who may be dirty, both in person and in clothes. The jailer, however, undoubtedly does his best to keep the bedding clean.

6. The amount of cubic space to be assigned to each person under the conditions existing in the jail is sufficient, provided that no overcrowding is permitted and that proper mechanical means are provided for securing efficient ventilation.

7. The ventilation is practically zero, no fresh air flues being provided, no adequate movement of air being required, and the egress of the vitiated air, except for the flues from the cells (and they may become stopped up) being under the control of the prisoners.

Respectfully submitted,
H. N. OGDEN,
Assistant Sanitary Engineer

ALBANY, N. Y., *December* 30, 1907.

CHARLES F. HOWARD, M.D., *President State Commission of Prisons,* 1458 *Main Street, Buffalo, N. Y.*

DEAR DOCTOR: — I beg to acknowledge receipt of yours of December 29, 1907, in regard to Cayuga county jail, and to say that I am inclosing herewith a copy of Mr. Ogden's report upon his inspection, made December 26, 1907.

I believe the report will be self explanatory, and will serve the purposes which you have had in mind in regard to remodeling the prison to conform with the law. If there are any matters in the report that are not perfectly clear to you I should be pleased to have Prof. Ogden explain them more in detail.

Accompanying Mr. Ogden's report were three tracings showing sketch plans of the prison, which I have not inclosed, since I have no prints of them at this time. In fact, it hardly seems as though these plans were a necessary accompaniment of the report, but in case you desire them, and will so advise me, I will have prints made of them and sent to you.

Sincerely yours,

EUGENE H. PORTER,

Commissioner of Health

BEDFORD

A petition was received from the board of health of the town of Bedford on April 2, 1907, requesting the Department to take the necessary steps to maintain the water levels back of the Muscoot dam at such a height through the season as to prevent nuisances which had occurred during the season of 1906 by reason of the lowering of these waters.

The matter was taken up with the New York city authorities and assurances were received that the gates would be opened to allow the flooding of the lands back of Muscoot dam.

DEXTER

ALBANY, N. Y., *August* 1, 1907.

Dr. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:—I beg to report that on June 10th I visited Dexter, Jefferson county, for the purpose of investigating an alleged public nuisance resulting from the operation of a sulphite pulp mill owned by the Dexter Sulphite Pulp and Paper Company.

The investigation was made in response to a request from Village Health Officer A. F. Morgan, M. D., inclosing a copy of a resolution which had been passed by the local board of health and a copy of which had been served on the pulp and paper company. This resolution stated, in substance, that the present operation of the sulphite pulp and paper mill produced noxious odors and gases which constituted a public nuisance, and which were detrimental to the health and comfort of the residents of Dexter. By the terms of the resolution the Dexter Sulphite Pulp & Paper Company were ordered to suppress and remove the said nuisance.

This resolution was passed August 16, 1906, and under date of March 13, 1907, Health Officer Morgan wrote the Department that the company had not responded to the demands of the board.

The Dexter Sulphite Pulp and Paper Company owns and operates a pulp and paper mill situated on the right or north bank of the Black river, near its mouth, in the lower limits of the village of Dexter, Jefferson county. Dr. James E. Campbell is secretary and treasurer of the company and Dr. Clarence W. Campbell is general manager.

The output of the plant is thirty-three tons of sulphite pulp, eighteen tons of ground wood pulp, and twenty-five tons of paper daily. The plant employs 250 hands.

The bisulphite of lime which is the acid used to dissolve out the lignin from the chipped wood, and thus separate the fibre, is prepared at the mill by passing burning sulphur fumes upward through towers stacked with lime rock and over which water is trickling.

The sulphur is burned in eight kilns, each of which consumes seventy to seventy-five pounds per hour while in use. There are eight towers each 108 feet high and five feet in diameter, in which the lime rock is stacked. The burning sulphur fumes are admitted to the lime rock towers after passing through 150 feet of cooler pipes attached to the towers. The sulphur fumes are drawn into the towers by forced draft until a circulation is started.

At the time of the inspection four sulphur kilns were in use, and, therefore, four towers were being operated for the production of the sulphite acid.

The sulphite acid is led from the towers to the acid storage tank partly by three-inch lead pipes and partly by open wooden troughs lined with lead. The acid storage tanks, three in number (with a fourth in process of construction), are twenty-four feet in diameter and fourteen feet high, and are constructed with wood and lined with brick. These tanks, along with three water tanks, are located parallel with and very near the southerly margin of Factory street. The acid storage tanks are entirely exposed, with no building or roof over them and the tops of the tanks are provided with loose manholes through which the acid fumes may pass.

From the acid storage tanks the acid is led in pipes to the steel digester tanks, eight in number, which are first partly filled with chipped wood and then nearly filled with acid. The cooking or digesting is then accomplished, during which process it is necessary to relieve the digesters of the sulphurous acid gas developed in the cooking. This gas is very valuable and is conducted back to the acid storage tanks in measured amounts, analyses being continually made of the acid stored in each tank to determine the amount of free lime in the solution so that the sulphur gas from the digesters may be turned into the storage tanks in such quantities that it will be taken up by the lime in each tank. Unless this operation is nicely adjusted some of the sulphurous acid gas will escape through the loose tops and manholes of the acid storage tanks.

The effect of the operation of the sulphite mill is very noticeable by reason of the absence of trees and grass for a radius of several hundred feet from the mill and the cause of this absence of vegetation is evidenced by the dead trees standing on the outskirts of the denuded section. The direction of the prevailing wind, which is west, is very plainly marked out on the ground by a broad path of bare soil leading away from the mill to the eastward.

At the time of the inspection the fumes from the mill, though disagreeably present, were not stifling as one passed along Factory street near the plant, but Health Officer Morgan and others interviewed stated that at times it was almost impossible to breath while passing the plant.

Nearby residents were interviewed and their evidence is here presented.

Mrs. G. M. Crittenton, who has lived since the fall of 1906 in a house located 1,000 feet easterly from the plant, stated that the odor from the plant is very disagreeable and stifling.

Mrs. Jere La Patrick, who has lived for twenty-three years in the house nearest to the mill, excepting one owned by the company directly across the street from the mill, stated that the family had never been able to raise vegetables or grow lawn or fruit trees since the operation of the mill was commenced, about eighteen years ago. A row of willow trees, set out on the property some years ago, were killed by the fumes. At times a stifling odor occurs.

One person, who requested that the name be omitted, and who resides some seven or eight hundred feet from the mill, stated that it was impossible to raise potatoes in their garden by reason of the fumes from the mill, although corn, string beans and peas will grow. The odor is at times stifling.

Three other persons residing within a radius of 1,500 feet refused to state any complaints against the existence of the fumes from the plant.

One person, who resided some 1,500 feet from the plant and who requested that the name be omitted, stated that although the fumes were somewhat disagreeable, the family were not very greatly inconvenienced by them. In no case, although the question was asked, was it stated that the fumes from the plant caused sickness.

In conclusion it may be said:

1. That the operation of the sulphite mill under present conditions occasions serious inconvenience and discomfort to many citizens residing within a radius of from 1,500 to 2,000 feet from the mill and thereby constitutes a public nuisance.

2. That the value of the property for a distance of four or five hundred feet from the plant is seriously impaired by reason of the fact that vegetation is killed by the fumes from the plant.

3. That the present exposed condition of several parts of the sulphite plant may be remedied, thereby removing to a large extent the present existing nuisance.

Respectfully submitted,

H. B. CLEVELAND,

Assistant Sanitary Engineer

ALBANY, N. Y., *August* 9, 1907.

MR. FRED ALLEN, *President Board of Health, Dexter, N. Y.*

DEAR SIR:—Some time ago the Department received from Dr. Morgan, the health officer of your village, a certified copy of the resolutions adopted by your board of health with reference to the sulphite mill of the Dexter Sulphite Pulp and Paper Company.

One of our inspectors visited Dexter some time ago but, owing to the large amount of work which the Department has undertaken this summer and the fact that he has been obliged to be away for considerable time, it has been impossible for him to make any report in the matter before.

I beg to inclose herewith copy of his report and I think there is no question but what your board of health has authority to deal with the question and that it should do so. Therefore, under section 25 of the Public Health Law, I hereby direct you to convene your board of health to take proper action in regard to the alleged nuisance, and I would suggest that the subject receive your serious consideration.

Would it not be advisable, in case your notice to the company is not obeyed, for your board to take the proper steps to secure an injunction restraining the discharge of these gases, etc., from the mill. You are required to see that the present condition is abated with as little delay as possible.

Kindly advise me as to the action taken by your board.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

GREENBURGH

Complaint was received on July 3d of insanitary conditions existing at Woodlands lake in the town of Greenburgh, Westchester county.

A report was received from the health officer and procedure under sections 25 and 25a was suggested to the complainant as the most feasible way to improve the conditions complained of.

GREEN ISLAND

ITHACA, N. Y., *October* 28, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.*

DEAR SIR: — In the matter of the alleged nuisance created by the dump on Green Island, complained of by Mr. H. L. Edson on June 4, 1907, and on later dates, I have to report as follows:

The statements of Mr. Edson as to the location of the dump and as to the fact of its continued use by the city of Troy are correct, and the facts are as stated. The city engineer of Troy, in his letter of August 8th, estimates the amount of garbage deposited on the dump weekly to be 422 1/3 loads, averaging two cubic yards per load, and he states further that the organic matter is raked together, and, with all combustible matter, is regularly burned in the furnace provided for that purpose.

On the occasion when I visited this dump, which, in spite of the statements of Mr. Edson, seems to be located in such a place that no public nuisance is to be feared, no odor whatever was perceptible. Kitchen garbage I found no traces of, but boxes, barrels, paper, street dust, and waste wool from factories made up the bulk of the garbage. The wool waste is carefully raked over, sorted, dried, baled, and sold, and whatever odor might exist on the dump would probably come from the dried wool waste.

I am of the opinion, therefore, that while the practice of dumping garbage of any sort is a method of disposal which will always be unsatisfactory and insanitary, and that the process of incineration is to be desired in all such cases, yet, in the case of this Centre Island dump, I do not feel that the Department would be justified in any attempt to compel the city of Troy to discontinue using its present dump, and in its stead construct and operate a garbage crematory.

Very respectfully,

H. N. OGDEN,
Assistant Sanitary Engineer

HUDSON

HUDSON, N. Y., *September* 26, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.*

DEAR SIR:—During the spring of this year your attention was called to an alleged nuisance emanating from the Hudson Portland Company's plant, in this city, in the nature of smoke and cement dust. At that time you informed us that an inspector from your Department would visit the plant and report thereon. On April 18, 1907, our board decided to let the matter rest for six months in order to have the matter thoroughly investigated. As the allotted time will soon expire we write for the purpose of apprising you of the fact and respectfully requesting a report and opinion from your Department. If your inspector has not yet made his visit to this city, we would suggest that he do so not later than the early part of October, as our health officer will be absent from the city for several days after the 15th of that month.

Respectfully yours,
HENRY HUDSON,
Mayor
LOUIS VAN HOESEN,
Health Officer
WM. WORTMAN,
Secretary

ALBANY, N. Y., *October* 24, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.*

DEAR SIR: — I beg to report that in accordance with your instructions Mr. H. B. Cleveland, Assistant Sanitary Engineer, visited the plant of the Hudson Portland Cement Company at Hudson, N. Y., on October 10, 1907, for the purpose of investigating the alleged nuisance said to be caused by smoke and cement dust from the plant.

'On September 26th, a communication from the Board of Health of the city of Hudson was addressed to this Department asking that an investigation be made and a report and opinion rendered by this Department, concerning the operation of the cement works at Hudson.

It appears from his report that the plant is located about a quarter of a mile southwest of the nearest residential portion of the city, between the New York Central & Hudson River railroad tracks. The plant has been in operation four years, employs 300 men, and the daily output is from 1,800 to 2,000 barrels of Portland cement.

In company with Mr. E. Bravender, superintendent of the plant, he inspected the various operations carried on at the plant.

In the manufacture of cement, five separate processes are required:

1. Drying of clay.
2. Preliminary grinding of rock.
3. Grinding of clay and rock together.
4. Burning or calcination.
5. Grinding of burned clay and rock.

Of these five processes, only the first and fourth, the drying of the clay and the burning of the mixture of ground clay and rock produce cement dust in quantities or in such a manner as to become a possible annoyance to residents of the city of Hudson. This is true from the fact that in these two processes only, furnaces with stacks are used in the operation. These two processes will be separately described and the loss of clay and cement discussed in relation to each process.

The clay used in the process amounts to 20 per cent. of the total product. This must be dried in rotating, cylindrical kilns before being ground with the rock particles. In drying the clay, some of the fine dust escapes through the stacks. The superintendent stated that the separate parallel firing cylinders which were observed in the plant had been constructed during the present season in connection with two of the three clay drying tubes and that the third clay drying cylinder was to be similarly fitted up. This arrangement permits part of the firing to be done in separate tubes instead of at the lower end of the tubes in which the clay is dried, thus allowing the gases from the furnaces to settle and deposit before being turned into the drying cylinder. It is claimed that this arrangement has considerably reduced the loss of fine clay.

In order to arrest the fine clay which escapes from the kilns, steam and water sprays have, during the present season, been installed in the stacks over the clay drying machines. By this means, a considerable amount of clay dust is arrested and the water and condensed steam containing the dust is then conducted outside the building.

At the time of the inspection, the amount of fine clay escaping from the stacks during the drying process was not such as to make it appear that any considerable annoyance arising from this part of the plant would be caused to the residents of the city even at such times as the direction of the wind was toward the city.

After the rock has been ground into particles and the clay and rock particles have been ground together, the mixture containing 20 per cent. clay and 80 per cent. ground limestone is burned to the point of vitrification in ten kilns consisting of rotating, cylindrical furnaces in which a temperature of 1500 degrees F. is maintained by the introduction of hot burning gases and an air draft and burning gas feeds to the burning kiln. It is mainly in this operation that the loss of fine cement occurs which gives ground for complaint.

At the end of four of the kilns, baffles have been constructed through which the burning gases and smoke, which carries fine cement, is passed in order to allow opportunity for a settlement or deposit of the cement before the smoke and gases are passed upward through the stacks. These baffles are simply large masonry or concrete boxes divided by vertical partitions into four compartments, the path of the smoke and gases being upward and downward over and under the partitions, which are about fifteen feet high, until the stack opening is reached. In this way a certain amount of the cement dust is settled out. However, the superintendent admitted that the installation of these baffles, which was accomplished during the present season, had not very materially reduced the amount of cement which is carried off during the burning process.

At the time of the inspection, it was not possible to observe the effect on the residential section of the cement dust carried in the air, since the direction of the wind was up the river and not toward the city.

In company with Dr. Louis Van Hoesen, health officer of the city, he went to the river bank about one-quarter mile upstream from the plant, at a point in the outer edge of the smoke and cement dust from the works to observe the effect of the operations. It was agreed that, at the time, it could not be said that a nuisance was created at this point, although out on the river the air seemed to be filled to a greater extent with smoke and dust.

It was stated by Superintendent Bravender and by Health Officer Van Hoesen, that there are not more than fifteen or twenty days in the year when the wind is from the west or southwest, and it is only on such days that the cement dust can to any appreciable extent affect any residential portion of the city.

The prevailing winds are from the north, northwest and southeast, and on account of the location of Mount Merino and other hills south of the city, a south wind is so restricted in direction that it does not carry the cement dust toward the city.

In conclusion, as to the nuisance arising from the operation of the cement works and the steps which may be taken for its abatement, it may be said:

1. That the Hudson Portland Cement Company are evidently making sincere efforts to reduce the amount of cement escaping from their stacks as is evidenced by the improvements occasioning considerable expense, introduced by the company during the past season.

2. That the smoke and cement dust from the plant does not affect the city to any material extent except during the fifteen or twenty days in the year when the wind is from the southwest.

3. That, from the statement of Health Officer Van Hoesen, it appears that all but one of the physicians of the city have stated that no cases of throat affection or other disease has been occasioned by the presence of the cement dust and the condition

SENECA FALLS

SENECA FALLS, N. Y., *May* 15, 1907.

The State Department of Health, Albany, N. Y.

DEAR SIRS: — I beg to call your attention to a condition of matters in Cayuga lake that, in my judgment, deserves investigation and prompt and thorough action on your part.

The west shore of Cayuga lake is fast becoming a foul and stagnant line of marsh and mud and filth and which could be very greatly relieved and changed for the better by a very little expenditure of time and money.

The New York Central railroad crosses the lake starting at the village of Cayuga, on the east shore of the lake, and running diagonally in a northwesterly direction across the lake. The current of the lake is to the north. There is a single opening under the tracks of the railroad which is east of the original center of the lake. From this opening supporting the railroad track, as it extends northwest, is a solid embankment of earth and stones. The result of this situation is that as the waters of the lake move toward the north and strike the railroad embankment they are deflected toward the west by the angle made by the railroad and thus are driven into the acute angled corner formed by the railroad and the west shore of the lake. There being no escape for this water, it naturally becomes stagnant and mud accumulates fast and settles, and the water being dead the flag and weeds form a rank growth; and added to all this is the fact, that there is a stretch of summer cottages extending for nearly two miles along the west shore of the lake, and also on the same west shore and within two miles is a very extensive and popular summer resort which is visited by thousands of people every day during the summer months and all the sewage and refuse thus carried into the lake from these places drifts along the west shore of the lake into the corner formed by the railroad embankment and the west shore of the lake and makes still further additions to the mud and filth that is continually settling in that part of the lake. If an opening could be made in the railroad embankment at the line of the flag so as to allow a current of water to flow through under the railroad and along the east edge of the flag, it would help very materially to cleanse and purify the waters on the west side of the lake and prevent the continual accumulation of mud and filth that is being continually brought into the lake from the west shore south of the railroad tracks. We believe that if the matter was presented to the railroad company by so influential and respectable a body as your board, it would very cheerfully make an opening at the place suggested. The expense of it would be very trifling compared to the great good that would result.

I have made a rough sketch of the situation, as I have explained it in my letter, and herewith inclose it to you.

Aside from the purely sanitary view, as above indicated, another idea might be suggested in connection with this matter and that is, that Cayuga lake is a public highway over which every one has a right to travel and which should be kept reasonably free from filth so that its use would not be disagreeable or dangerous. The rights of travelers upon the lake call for a cleaner and safer condition of the highway which it has the right to use.

Your early attention to this matter will be greatly appreciated by many thousands of people who make use of Cayuga lake for purposes of travel and pleasure.

Very truly yours,

J. N. HAMMOND

ITHACA, N. Y., *June* 1, 1907.

DR. E. H. PORTER, *Commissioner of Health, Albany, N. Y.*

DEAR SIR: — Replying to your letter of instruction of May 23d, in the matter of the alleged pollution of Cayuga lake and the public nuisance caused by the embankment of the New York Central railroad across the north end of the lake, permit me to advise you as follows:

In the course of my visit to Seneca Falls yesterday, I was able to confer with Mr. Hammond, of the firm submitting the letter of complaint, in regard to the matter. I assured him that you were anxious to remedy any evils which might exist there but pointed out to him that since it might be necessary to force the railroad to go to the expense of the waterway which he desires, it would be necessary for you to obtain evidence, first, of the existence of a public nuisance existing there, and second, that the nuisance was due to the acts of the railroad company. There are no cottages within a half mile of the weeds and sedge which he alleges are caused by the embankment and it is difficult for me to believe that the mere existence of a growth of weeds is a menace to public health. He assured me that there were odors to be readily detected at times of hot weather at the cottages but that the present was not a desirable time to visit the locality on account of the continuous cold weather. He acknowledged that the refuse along the shore, from which the smell might come, was largely house refuse dumped into the lake from the cottages, and that this procedure would continue to furnish odors even if the waterway was provided. It does not seem to be possible to definitely assert that the waterway would prevent the further development of the weed growth, but it is assumed that because the conditions now are different from the conditions existing fifteen years ago when the embankment was built, that therefore the changed conditions are due to the embankment.

Mr. Hammond is to notify me of the time, perhaps two weeks hence, when the odors are prevalent and when it would be desirable for me to visit the locality. Meanwhile, he is content to let the matter lie, while he considers whether it will be possible to present enough evidence to convince you of the existence of a nuisance and of the responsibility of the railroad for the same.

Yours respectfully,

H. N. OGDEN,

Assistant Sanitary Engineer

ALBANY, N. Y., *August* 14, 1907.

Dr. E. H. PORTER, *Commissioner of Health, Albany, N. Y.*

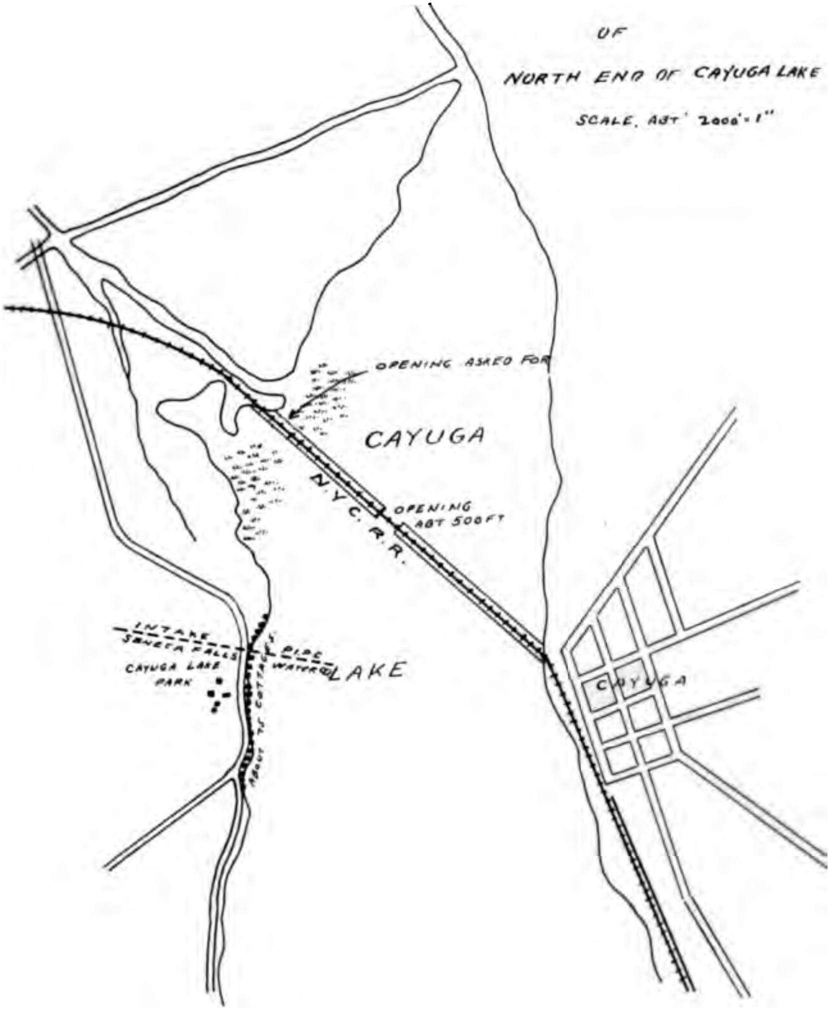
DEAR SIR: — I have to report that on Monday, August 12th, I visited the village of Seneca Falls and in company with Mr. W.

SKETCH PLAN

OF

NORTH END OF CAYUGA LAKE

SCALE, ABT 2000'=1"



B. Harper, member of assembly from Seneca county, and with Dr. Medden, health officer of the village of Seneca Falls, inspected the conditions along the shores of Cayuga lake complained of as a nuisance.

I submit herewith a sketch map showing the relative location of the cottages on the west shore of Cayuga lake and the embankment of the New York Central railroad — the effect of the latter being claimed to produce excessive growth of weeds and water plants in the northwest corner of the lake. Said excessive growth of weeds producing, according to the complainants, bad odors and conditions prejudicial to health.

I find that from the northwest corner of the lake to a point below Cayuga Lake Park, a distance of about one mile, are located about seventy-five cottages and the park, which has an attendance of about a thousand on days of large attendance.

Nearly every one of the cottages discharges sewage and domestic wastes directly into the lake, the waters of which are very shallow, the condition producing a large growth of weeds and algæ. The dense growth of flag and cat-tails projects into the lake about an eighth of a mile south of the railroad embankment, cutting off whatever current might exist along the shore northward. It was claimed by the health officer, who has a cottage on the shore at the end of a small bay where the vegetable growth is densest, that this growth of flag is continually increasing and that land is being made at the rear of the growth. He further stated that the growth of seaweed (so-called) in the water along shore is continually denser and denser and that the beach is being spoiled for bathing and boating.

It is the desire of the cottagers that this Department take up the matter with the New York Central railroad requiring them to construct an open waterway at the western end of their embankment in line with the west shore of the lake, in order that a current may be established through the embankment into the waters of a stream adjacent to the embankment on the north side, the stream being known as the Dimont river.

Attached herewith, you will find affidavits submitted by the health officer and by Mr. Harper as to the extent of the nuisance caused by the decay of the vegetation above referred to. On the date of my visit no such odor was perceptible and in my opinion the growth of algæ and other vegetation could not be classed as a public nuisance or as a menace to health. In my opinion, if the cottagers have any remedy in the matter it must be sought, not from this Department, but from the Public Utilities Commission or by civil action.

Respectfully submitted,
H. N. OGDEN,
Assistant Sanitary Engineer

ALBANY, N. Y., *August* 21, 1907.

MR. WILLIAM B. HARPER, *Seneca Falls, N. Y.*

DEAR SIR:— With reference to the alleged insanitary conditions on Cayuga lake, I beg to inclose herewith copy of the report of our engineer, who made the inspection recently.

I wish to call your attention to the conclusions in his report. After going over the matter carefully with him, I am of the same opinion as expressed in the report, that the conditions cannot be classed as a public nuisance or as a menace to health, and that they are not therefore under the control of this Department.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

SYRACUSE

SYRACUSE, N. Y., *November* 1, 1907.

DR. E. H. PORTER, *Commissioner, New York State Department of Health, Albany, N. Y.*

DEAR DOCTOR: — The proposed raising of Onondaga lake in the construction of the barge canal in the opinion of many will be a serious menace to the health of the city of Syracuse. It is the present plan to raise the dam at Phœnix about four feet which will result in raising the water in Onondaga lake nearly as much. This will mean the transforming hundred of acres of good land into swamp, which will be flooded at times and then again left to partially dry. At a conference with Mr. E. A. Powell, chairman of a special committee of the Syracuse chamber of commerce to consider this matter and with Dr. John Heffron, chairman of the committee on public health of the Onondaga County Medical Society, and of the similar committees in both the Syracuse Academy of Medicine and of the New York State Medical Society, they requested me to state to you that it is the wish of the committees they represent that they join with the health committee of the Syracuse chamber of commerce, which I represent, in asking you to send a sanitary expert from your department to investigate the situation and advise us in this matter. It is very necessary that this be done at once as the canal officials are to grant a hearing upon the question the 6th instant. If you send a man here, we will be pleased to furnish him with abundant data and we will gladly go over the ground with him and assist him in every way possible.

Respectfully yours,

B. W. SHERWOOD,

Chairman Health Committee of the Syracuse Chamber of Commerce

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ALBANY, N. Y., *November* 9, 1907.

HENRY C. ALLEN, *City Engineer, Syracuse, N. Y.;* A. LEE OLMSTED, *Attorney for Abutting Property Owners,* 500–501 *Kirk Building, Syracuse, N. Y.;* E. A. POWELL, *Chairman Committee Phœnix Dam, Appointed by Chamber of Commerce, Syracuse, N. Y.*

GENTLEMEN :— Replying to the following questions submitted by you to the State Engineer and Advisory Board of Consulting Engineers on September 20, 1907, we herewith submit our answers to the same.

1. What is the general plan of the improvement at Phœnix? A. A dam and lock.

2. What is the elevation of the present dam? A. 359.13.

3. What is the elevation of the crest of the proposed new dam? A. 363.

4. Will the new dam be a fixed or a movable dam? A. Under date of October 15, 1906, the Advisory Board of Consulting Engineers recommend the following:

"Resolved, That this Board recommends to the State Engineer the construction of a fixed dam at Phœnix, to be located between the site of the present dam and the bridge at Bridge street, on the Oswego river, in said town. Said dam to be a curved dam, with a radius of about 200 feet and a crest length available for spillway of not less than 775 feet."

However, this a question that has not yet been passed upon by either the State Engineer, or the Canal Board.

5. If movable, at what height is it proposed to maintain the fixed portion? A. Undetermined.

6. Assuming the dam to be fixed with a crest at 363, what is computed to be the elevation of water in Onondaga lake with such a dam at maximum, minimum and mean flows of the river at Phœnix of, say, 25,000, 2,500 and 5,000 cubic feet per second respectively? A. Gauge readings indicate that the ordinary maximum of floods will not greatly exceed 20,000 cubic feet per second in the Oswego river, and 10,000 cubic feet per second in the Seneca river. Hence the maximum discharge has been taken at the above figures.

Below the discharge of 5,000 cubic feet per second, the slope is too flat to compute with any degree of accuracy. At such times the elevation at Onondaga outlet, or Baldwinsville, will probably be between 0.1 and 0.5 feet greater than that above the Phœnix dam. The elevation at Phœnix dam at low stages will not be below 363 and the amount it exceeds that elevation will be dependent upon the amount of water passing through the mills and lock.

The figures here given for 5,000 cubic feet per second discharge or less show the elevations at points along the river when the entire flow is passing over the dam, and therefore represent the worst possible conditions so far as the height of the water is concerned.

The following are the elevations at points in question with discharge of 20,000 cubic feet per second, and 5,000 cubic feet per second under the conditions above imposed: 20,000 C. F. S. at Onondaga outlet, 367.7; 5,000 C. F. S. at Onondaga outlet, 364.58. In both cases all water assumed to be flowing over the dam at Phœnix. With powers in operation these elevations would be reduced.

7. Assuming the fixed dam to remain as it is, but with a movable crest constructed, what is computed to be the elevation of the water in Onondaga lake at the flows stated in the last question? A. 20,000 C. F. S., elevation 366.45; 5,000 C. F. S., elevation 365.35.

8. How much, and what lands lying around Onondaga lake will be affected by submergence and saturation? A. See contour maps.

9. Is it contemplated by the State to acquire title to lands submerged and saturated, or to pay damages for flooding and saturating the same? A. This is a legal and not engineering question.

10. If a new fixed dam is built, what is its proposed crest, length and form, also its location? A. Exact form not yet determined. The above water elevations are based on crest length of 691.2 feet, curved type, with radius of about 220 feet.

11. What is the length of the present dam? A. 438 feet.

12. Can we be furnished with a copy of Mr. Horton's report on a fixed dam at Phœnix? A. The report asked for is now somewhat obsolete, but it is believed that the information you require is given in answers to the within questions.

13. What is the estimated cost of deepening the channels in the Oswego, Oneida and Seneca rivers to build the canal without raising the dam at Phœnix? A. It is believed that such a change in the natural elevation of the river beds in question would so affect the regimen of said rivers at certain points as to make the design an impracticable one, owing to the treacherous character of the earth material.

14. If it is contemplated to acquire a title to land damaged around Onondaga lake, what elevation has been, or will be prob-

ably decided upon below, which such lands will be acquired? A. Knowing the elevation at which the changed conditions will flood adjacent lands, the question of damages, if any, is one to be adjusted with the individual property-owner.

15. (a) What effect, if any, will the raising of the dam at Phœnix have upon the water power rights at Baldwinsville? (b) Will the water below the dam at Baldwinsville be affected and if so how much at the maximum, mean and minimum flows above referred to. A. (a) Conditions below the Baldwinsville dam will be changed but little. Probably there will be a slight increase of head at Baldwinsville due to lowering the water when Phœnix mills are running. (b) At flood times computations show that the changed conditions will lower the water elevation below the Baldwinsville dam. At mean and minimum flows the conditions will not be greatly changed.

16. What is the width and depth of the proposed channel from the Phœnix dam to the outlet of Onondaga lake? A. Canalized river with minimum cross section of 200 feet; twelve feet depth.

17. What is the proposed width and depth of the canal leading from Onondaga lake to the Seneca river, and will it follow the present channel? A. See Canal Act, chapter 147, Laws of 1903.

18. What effect is it computed that the widening and deepening of the river above Baldwinsville will have upon Onondaga lake in a quicker discharge of the high water from the Montezuma marshes? A. The effect is indeterminate and probably immaterial.

19. With the proposed improvements in the Seneca river, will it be a more frequent occurrence that the water from the river will back in, and fill up and raise the lake? If so what data have you upon the subject? A. See answers to above questions.

20. Will the proposed raising of the dam and lake affect the sewerage and drainage of the New York State Fair Grounds, the village and plant at Solvay, and the Halcomb Steel Works? A. See answers to above questions.

Respectfully submitted,

FREDERICK SKENE,
State Engineer and Surveyor
EDWARD A. BOND,
Chairman Advisory Board of Consulting Engineers

ALBANY, N. Y., *November* 9, 1907.

B. W. SHERWOOD, M. D., *Chairman Health Committee of Syracuse Chamber of Commerce, Syracuse, N. Y.*

DEAR SIR:—I am sending you herewith the report of our Chief Engineer, Mr. Theodore Horton, upon the results of his investigation of the conditions with respect to water levels in Onondaga lake, carried out in accordance with the request in your letter of November 1, 1907.

I believe Mr. Horton has considered the question very carefully and although he emphasizes that the conclusions are somewhat tentative owing to lack of information of facts, I believe they were carefully reached and will be of assistance to you and your committee in meeting the situation.

If there are further suggestions or assistance I can give you in the matter, I will be pleased to do so.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

ALBANY, N. Y., *November* 6, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR: — In accordance with your directions and the request of Dr. B. W. Sherwood, chairman of the health committee of Syracuse chamber of commerce who, in behalf of said and other local health committees of Syracuse, has requested the advice of this Department as to the effect of the possible fluctuation of the water levels of Onondaga lake incident to the proposed improvements to the barge canal, upon the public health of Syracuse, I beg to report as follows:

On November 3d, I visited Syracuse and during the morning conferred with Dr. Sherwood in regard to sentiment and action of the various committees above referred to in the matter of the possible and probable changes in the water levels of Onondaga lake and the possible resultant effects upon public health of Syracuse. I conferred also with Mr. H. C. Allen, city engineer, who is well familiar with the general engineering features associated with the proposed work of the barge canal, and examined reports, plans, profiles and hydraulic data which were on file in his office. I further conferred with Mr. F. A. Powell, chairman of the special committee of the Syracuse chamber of commerce, in regard to the general question before us and in particular to the effect of the proposed changes in water level due to barge canal operations in past years and the possible changes due to future operation.

During the afternoon, in company with Dr. Sherwood, Mr. Powell and other gentlemen, I drove around and inspected the shores of Onondaga lake. I examined the sanitary conditions of the shores, the extent and character of land that might be flooded by any raising of the water level of the lake, and the points of present and proposed sewage outfalls of the city. I also had pointed out to me the location and extent and nature of the changes contemplated in the construction of the barge canal and the lands which it was feared might be flooded and damaged, and otherwise result in conditions which might be a menace to health.

Briefly described, the proposed work of the construction of the barge canal as affecting Onondaga lake and the city of Syracuse, as I understand it from the data furnished me, will comprise the canalization of Seneca river, Onondaga outlet and Onondaga lake by the construction of a new dam, or the raising of the present dam at Phœnix to a level of 363, or by other improvements to the channels of these waterways. The type of dam which it is proposed to construct has not yet been decided according to the communication of the Canal Advisory Board to Messrs. Allen, Olmstead and Powell dated October 16, 1906, but, so far as could be inferred from the letter, the dam would be a circular fixed dam of about 200 feet radius or some form of movable crest dam constructed on the line of the existing one at Phœnix.

The dam at Phœnix is 438 feet long with crest at an elevation of about 459.0. The length of the proposed circular dam is 775 feet with fixed crest at an elevation of 363.0. The length of the alternative proposed movable dam would be approximately 438 feet with movable crest ranging from some level between its present fixed level of 459, and elevation 463.

The questions at issue and about which there seems to be some uncertainty are:

1. What effect will the fixed type of circular dam now favored by the Canal Board have upon the water levels in Lake Onondaga?
2. What effect will any fluctuation, or permanent rise, in the water level of the lake have upon the public health of the locality?
3. Would not the substitution of a movable type of dam remove entirely or appreciably any possible objectionable influence upon the water levels in Onondaga lake resulting from the construction of a fixed dam.

Members of the local committees, above mentioned, have already sought information in regard to these questions directly from the Advisory Board of Consulting Engineers for the barge canal. The replies to a series of questions received by them from the Advisory Board give in a large measure the information sought, but, at the same time, do not give in as full a manner, nor in the degree of definiteness desired, sufficient information to remove the uncertainty which prevails in the minds of many members of the local committees. I have, therefore, carefully considered not only these replies but other engineering computations and data in the hands of the local city engineer's department and feel that there are reasonable grounds for at least some uncertainty as to the effect of the proposed types of dams upon the water levels of the lake as stated in the communication from the Canal Advisory Board.

In reviewing these questions and answers which passed between the local committees and the Board of Advisory Engineers, I have studied and checked over the figures as given by them so far as they can be checked with the limited information available. The most important questions are Nos. 6 and 7, which refer to the lake levels under conditions of 5,000 and 20,000 cubic feet per second flow with the two types of dams. Question No. 6 refers to a fixed dam with crest of 363, and question No. 7

to the present dam (or an equivalent of the same) with a movable crest. These two questions will be considered separately, but before doing so, a brief statement will be given of the salient factors governing the relation of these crest elevations to water levels in the lake.

In the waterway above the dam at Phœnix, including Seneca river and Onondaga outlet, after these have had the channels widened and deepened, the amount of backwater (that is the relation of the elevation of the *water level* in the *lake* to the *elevation* of the *crest* of the *dam*) will depend upon the volume of flow and the length of the crest if a fixed dam is used, or the length and adjustability of the crest if a movable dam is used. The total backwater may be considered made up of the head required to discharge a volume of water over the crest at the dam (which I will term "Weir Head") plus the head, or fall required to remove the volume of water in the river from the lake down to the dam at Phœnix (which I will term "slope head.")

Now the "weir head" for a dam with a fixed crest would be, for a flow of 5,000 cubic feet per second, about one and one-half feet for a crest 775 feet long, and about two and one-quarter feet for a crest 438 feet long. The slope in the river channels from the lake to Phœnix would, for a volume of 5,000 cubic feet per second flow, and according to answer No. 7, approximate 0.5 feet, a figure which, after approximate computations, I have little reason to doubt. These figures would indicate that for the long circular crest mentioned with elevation fixed at 363, and a flow of 5,000 cubic feet, a water level in Onondaga lake of approximately 365.0, with flows ranging from 5,000 down to, say, 2,500 cubic feet, per second, these water levels in the lake would range from 365 to about 363.5.

In other words, it appears that for a period of six months or more in the year, i. e., from June to December, with a fixed type of circular dam having a length of crest of 775 feet, the water levels in the lake would only fluctuate between the elevation 363.5 and 365.0. At other seasons of the year, when the rivers would be in flood, the levels would rise as in the past to stages in close proximity to 368.0. The main point to keep in mind is that the construction of a circular dam at Phœnix with crest 775 feet long, would raise the average summer flow, which now ranges from say 360 to 363, to a level that would fluctuate approximately from 363.5 to 365.0.

Considering now the movable type of dam, it appears that by adjusting the height of the crest, it is possible to keep the water level just above the crest of the dam at a fixed elevation, such as 363, by raising and lowering the crest according to the volume of flow. In other words, when the volume of flow increases, it is only necessary to lower the crest in order to keep the water level at the fixed elevation of 363.0.

If, then, the Canal Board should use the present dam and construct a movable crest having maximum elevation at 363 (i. e., a range of four feet) then it would be possible to maintain a 363 water level back of the dam for volumes of flow ranging from zero to that corresponding to four feet head on the crest, corresponding approximately to about 11,000 cubic feet per second. The water level in the lake would then be governed only by the "slope head" which would range from 0.1 to 0.5 feet up to 5,000 cubic feet per second and probably as much as say 2.0 feet for a flow of 10,000 cubic feet per second.

It is evident then that with a movable crest dam, the water surface in the lake could be maintained at a more uniform level for much greater volumes of flow than if the dam were a fixed one with a crest that could not be lowered below 363. This factor may in fact be a very important one when we consider, first, that improvements are contemplated on the Seneca river above Onondaga outlet that may bring down slightly larger volumes of water during the summer season a flow considerably in excess of 5,000 feet might occur, in which case the water level in the lake would rise higher than elevation 365.0 and a flooding of a considerable area of land, adjacent to the lake, might result.

It appears then from the facts in the case, so far as I could determine from the rather incomplete data and records furnished me:

1. That with a fixed dam of circular type with crest 775 feet long, it may be expected that the water level in the lake during six months of the year will be raised somewhat and will fluctuate ordinarily between 363.5 and 365.0; and that possibly elevation

365.0 might be exceeded should a flow in excess of 5,000 cubic feet per second occur during this period of the year.

2. That in general a movable crest dam would permit the water level in the lake to be maintained at a more uniform level than could be obtained by use of a fixed dam, and for much greater volumes of flow than 5,000 cubic feet per second.

3. That with the use of either type of dam the flood levels in the lake will not vary to any considerable extent from those that have been occasioned in the past.

4. That the construction of a fixed type of dam, such as that proposed having a length of 775 feet, and crest at elevation 363.0, would, by maintaining the water surface in the lake at a more uniform level than has occurred in the past, not be a detriment to the sanitary condition of the locality; but, on the contrary, providing the outlet of the proposed intercepting outfall sewers of the city are maintained with inverts not lower than elevation 364.0, there would in all probability be a considerable improvement in these sanitary conditions surrounding the lake.

5. That a movable dam would enable the water level in the lake during the dry six months of the year to be maintained at not only a more uniform level but at a lower level than would be possible with the use of a fixed dam, and still permit the water level in the Seneca river above the proposed dam to be maintained at the elevation 365.0, desired by the Canal Board; and that, consequently, the increased benefit derived from these more uniform conditions would indicate the superiority of the movable type of dam over the fixed type.

I beg to say that the foregoing consideration and conclusions have been based upon premises which have been in a measure presumptive. I was unsuccessful in finding on two occasions representatives at the barge canal office in Albany from whom I could secure explanations as to the possible types of dams which it is proposed to construct and operate, nor was I able to verify any of the data furnished me at Syracuse. I believe, however, that the facts presented and assumed are approximately correct and that the conclusions based thereon are correspondingly correct.

Owing, however, to the urgent request of the local committees and in view of the early date of the hearing of the Board of Advisory Engineers, on the matter, it seems desirable that this report with its tentative conclusions be forwarded without delay.

Very respectfully,

THEODORE HORTON,

Chief Engineer

INVESTIGATIONS ORDERED BY THE GOVERNOR

INVESTIGATIONS ORDERED BY THE GOVERNOR

During the year 1907, two important investigations were undertaken in accordance with special order of the chief executive, acting under the provisions of section 6 of article 1 of the Public Health Law. These investigations were made the subject of special studies and reports, and were in relation to the following:

1. The pollution of the upper Hudson river and its tributaries by wastes from pulp and paper mills and other industrial establishments.

2. The pollution of the Grasse (or DeGrasse) river by the wastes from the DeGrasse Paper Company at Pyrites.

In both of these investigations the combined resources of the Sanitary Engineering Division and the Hygienic Laboratory were called upon. The questions at issue were vital, not only in their relation to the health and comfort of the residents of this particular section of the State, but also the broader and more comprehensive problem of the proper disposal of domestic sewage and industrial wastes in the entire State. Although considerable time was consumed and much detailed examination and study were expended upon the two investigations, a large amount of valuable information was obtained and important conclusions were reached.

In addition to the above investigations carried out under specific executive order, other investigations have been referred to the Department from the Executive Chamber. They have been in the nature of complaints of lesser importance, but have, nevertheless, been made the subject of careful investigations and reports. These investigations were in relation to the following:

Ballston Spa.— Pollution of Kayaderosseras creek by the wastes from the Union Bag & Paper Company.

Catskill.— Pollution of Catskill creek.

Hollywood.— Pollution of Raquette river.

Hornell.— Pollution of Canisteo river.

Hudson river.— Pollution of ice fields.

Hutchinson canal.— Pollution by sewage from Mount Vernon, Pelham and Pelham Manor.

New York city.— Pollution of Croton water supply.

Stony Point.— Nuisance arising from insufficient drainage.

REPORT ON THE POLLUTION
OF THE
UPPER HUDSON BY INDUSTRIAL WASTES

SUBMITTED BY STATE COMMISSIONER OF HEALTH
PURSUANT TO AN ORDER OF THE GOVERNOR

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REPORT ON THE POLLUTION OF THE UPPER HUDSON BY INDUSTRIAL WASTES

Hon. Charles E. Hughes, *Governor of the State of New York, Albany, N. Y.*

Sir: — I have the honor to submit herewith my report upon the investigation of the pollution of the upper Hudson river in the counties of Washington, Warren and Saratoga, resulting from the discharge therein of sludge acids and of wastes from pulp mills and other industrial establishments.

This investigation was undertaken pursuant to an executive order, dated May 17, 1907, requiring the Commissioner of Health in accordance with the provisions of section 6 of article 1 of the Public Health Law to make an examination into the alleged nuisance and questions affecting the security of life and health in the locality aforesaid, and to report the results thereof to the Governor on or before the 15th day of August, 1907. Copies of the complaint and order appear among the appendices.

The work was begun immediately and the investigation has occupied a large part of the time of the division of Sanitary Engineering and the Laboratory since it was begun.

A public hearing was held at Fort Edward, N. Y., by the Commissioner on July 2, 1907, notice of which was served on all the persons whose names appeared on the complaint, and to the Governor, and such notice was also published in several newspapers in Fort Edward, Keeseville, and Glens Falls. This notice required all the petitioners, complainants, riparian owners, and the owners, proprietors or managers of pulp mills, factories and other industrial establishments, and all other persons interested therein, to appear before the Commissioner of Health for the purpose of giving testimony regarding said complaint. A copy of the notice above referred to and the evidence taken at the hearing are presented herewith.

Previous Investigation of Pollution of the Hudson River by the State Department of Health

The pollution of the Hudson river, including the upper Hudson, has been the subject of general and special investigations by the State Department of Health on a number of occasions. Some of them have been made with respect to general pollution by both industrial and domestic sewage while others have been more specific with respect to some mill or municipality involving a question of local nuisance or a problem of sewage disposal. The more important of these investigations which have been made and reported in the Annual Reports of the Department are as follows:

1. "Report on the Hudson River," by C. C. Brown, C. E., in the Tenth Annual Report of the State Board of Health for the year 1890. This report was in the nature of a preliminary report and was limited to an examination of the sanitary conditions of the coves created by the railroads located on the east and west shores of the Hudson river below the Mohawk river.

2. "Second Report on Hudson River," by C. C. Brown, C. E., in the Eleventh Annual Report of the State Board of Health, for the year 1891. This report was somewhat more comprehensive than the preceding one, and included a statistical study of the growth of population upon the watershed of the Hudson river, of the ice industries situated along the river, and of the sources of water supplies of the municipalities located along the river and its tributaries.

3. "Third Report on Hudson River," by C. C. Brown, C. E., and Theobald Smith, M. D., in the Twelfth Annual Report of the State Board of Health for the year 1892. This report covered an investigation of the purity of the waters of the Hudson river and its principal tributary, the Mohawk river, with respect to the question of water supplies of cities and villages situated near them. This report was more special in its nature and was the first to include a comprehensive chemical and biological examination of the water of the Hudson river.

4. "Fourth Report on Mohawk and Hudson River," by C. C.

Brown, C. E., and Theobald Smith, M. D., in the Thirteenth Annual Report of the State Board of Health for the year 1893. This report covered an extension of the chemical and biological studies undertaken and reported upon in the previous year in relation to the Hudson river, and included special studies of pollution and sedimentation by bacteriological methods. The report also contains the first published description of the method of quantitatively determining the pollution of water by fecal bacteria.

5. A report on the "Saratoga Lake Nuisance," carried out under the special order of His Excellency, Governor Roosevelt, in the Thirteenth Annual Report of the State Board of Health, for the year 1899. This report covered an investigation of the pollution of the Kayaderosseras creek by certain industrial establishments and the villages of Ballston Spa and Saratoga Springs. This report was made the basis of executive orders; first, prohibiting a further pollution of the shores of Saratoga lake by the adjoining hotels, cottages, and dwellings; secondly, requiring sewage purification works for a treatment of the sewage of Ballston Spa and Saratoga Springs; and thirdly, a removal of the wastes of the Hall, Haight & Company tannery and of the George West Paper & Bag Company from Kayaderosseras creek.

6. "A report on the Pollution of the Upper Hudson River," by H. B. Cleveland, Assistant Sanitary Engineer of the State Department of Health, in 1907. This investigation and report was made under the immediate direction of this Department, and although it covered in a cursory manner statistics of the discharge of sewage into the upper Hudson from the mills and population upon the drainage area, the very limited time that was available at the time of this investigation made the report necessarily a somewhat incomplete one.

Since the present investigation deals more particularly with pollution from pulp and paper mills, reference should be made here to the two similar investigations of the pollution by pulp mills of the waters of Lake Champlain.

One of these investigations was made by the State Department of Health under special order of Governor Odell in May, 1904, and was reported in full in the Twenty-fifth Annual Report of the State Department of Health for 1904, pp. 620–645. It included a study of the pollution of the Bouquet and Ausable rivers from mills of the New York & Pennsylvania Company located at Willsboro and the J. & J. Rogers Company at Ausable Forks.

The other investigation was made by the United States Geological Survey in the latter part of the same year. This investigation was more general in its nature and included a study of the pollution from both domestic sewage and industrial wastes, of the waters of Lake Champlain in the States of New York and Vermont. The report of this investigation was published as a special document of the U. S. Geological Survey, in Water Supply and Irrigation Paper No. 121, 1905.

The reports of these two investigations, although differing as to their scope and general conclusion reached, are however quite complete, and furnish considerable information as to the general question of pulp mill pollution and more particularly of its effects upon the waters of Lake Champlain.

Supplementing the above-mentioned report on the pollution of the Ausable river from the J. & J. Rogers Company, a second inspection and report was made by the Department in December, 1906, for the purpose of comparing what changes, if any, had been made in the conditions of pollution of Ausable river and of what methods of purification, if any, had been introduced by this mill for the disposal of their sulphite waste liquor. This report is on file in the Department and is published in the Twenty-seventh Annual Report of the State Department of Health for 1906.

Nature and Scope of Present Investigation

Sections IV to VI inclusive of the petition to the Governor refer to the pollution of the Hudson river exclusively by wastes from "pulp mills, factories and other industrial establishments." The Governor's order, however, is more broadly and cautiously drafted and imposes an examination into not only the alleged nuisances cited by the petitioners but to "such other questions as affect security of health and life."

I have, therefore, included in this investigation; first, an examination of the nature and extent of pollution from the mills and establishments that discharge industrial wastes into the Hudson river; secondly, an examination and study of the domestic sewage discharged into the Hudson river by the population resident upon the watershed; and thirdly, a study of the effects which these two classes of wastes or sewage have, first, upon the comfort and convenience, and, secondly, upon the health and life of the citizens residing along or near the banks of the Hudson river and its tributaries.

This investigation was started early in June and continued through the greater portion of June and July. The field work included a careful inspection of the sewer outlets of all mills and municipalities contributing pollution to the river. In the case of the mills a study was made of the different processes employed in each mill in the manufacture of their respective products; the character and quantities of the wastes or by-products resulting from the processes; the points where these wastes were discharged into the streams; and the effects which these discharges have upon the pollution of the stream, so far as they were evidenced by the senses. In the case of municipalities studies were made to determine the extent and effect of the discharge of domestic sewage from each of the villages and cities located along the river. While these studies were in progress, other evidence of a confirmatory nature was being collected by means of chemical and biological analyses of samples of the different wastes, and of the river water at various points above and below the points of pollution. Finally corroborative evidence of a testimonial nature was gathered from residents along the river who were directly or indirectly affected by the pollution, including a number of the citizens who were particularly interested as petitioners.

A detailed description will now be given of the character and extent of work carried out, and the results reached, in this investigation, and in order that these may be more clearly understood, the remainder of the report will be considered under the following subdivisions:

I. Topography, Geology and Hydrology of the upper Hudson river.

II. Pollution of upper Hudson river by industrial wastes.
  (a) Character of industrial wastes.

- (b) Processes employed in the various mills.
- (c) Statistical summary of pollution from industrial wastes.

III. Pollution of the upper Hudson river by domestic sewage.
- (a) Pollution by urban and rural population.
- (b) Statistical summary of pollution from domestic sewage.

IV. Chemical and bacteriological analyses of Hudson river water.

V. Discussion of the extent and effect of the pollution of the Hudson river.
- (a) Extent of pollution.
  - (1) From industrial wastes.
  - (2) From domestic sewage.
- (b) Effect of pollution.
  - (1) From industrial wastes.
  - (2) From domestic sewage.

VI. Means for elimination of pollution.

VII. Summary and conclusion.

VIII. Recommendations.

I. TOPOGRAPHY, GEOLOGY AND HYDROLOGY OF THE HUDSON RIVER

Topography

The Hudson river is the most important river of the State. The lower portion from its mouth to the Mohawk is a great inland tidal estuary, forming an important channel of commerce. Its upper portion above the Mohawk is noted for its many falls and beautiful scenery which afford water power to many industries and numerous resorts for pleasure and health.

The Hudson river rises in the southern tier of the Adirondack mountains in a chain of small lakes in the western part of Essex county. The headwaters may be considered as issuing from lakes Henderson and Colden, having elevations of 1,810 and 2,764 feet, respectively, above mean sea level. From this chain of lakes the river flows in a generally southerly direction to Palmers Falls where it turns and continues in a northeasterly direction for a distance of some fifteen to twenty miles to Glens Falls where it again turns sharply and continues in an almost directly southerly direction to the Mohawk river and beyond to the waters of New York bay.

The drainage area of the Hudson river above the Mohawk river, which is the lowest point along the river included in this investigation, is 4,620 square miles. There are five main tributaries to the river above this point and these will be described in the order of their confluence with the main river, going north from the Mohawk, as follows:

1. The Hoosick river, which enters from the east, has a total drainage area of 730 square miles; 225 square miles of which are in the State of Massachusetts, 275 square miles in the State of Vermont and 230 square miles in the State of New York. It rises in the Green mountains in Berkshire county in Massachusetts, and flows northerly, crossing the southwestern corner of Vermont and into New York, thence through Rensselaer county to the Hudson opposite the village of Stillwater. The country drained is mainly mountainous with summits reaching elevations of from 1,000 to 2,000 feet above mean sea level. There are many water powers developed in all three of the States, as a result of the steep profile of the river. The principal tributaries are the Little Hoosac and Tomhannock entering from the south, and the Walloomsac, entering from the north.

2. Fish creek, which enters from the west at Schuylerville, has a drainage area of 253 square miles. It is the outlet of Saratoga lake and its principal tributary is Kayaderosseras creek, which drains the central portion of Saratoga county and enters Saratoga lake about one mile above the outlet of the lake. While the drainage area is not large nor the profile very steep, there are a number of water powers along these streams.

3. The Batten Kill, which enters from the east, has a drainage area of 460 square miles, of which 220 square miles are in the State of Vermont and 240 square miles in the State of New York. It rises in the Green mountains in Bennington county, Vermont, in the town of Dorset, and flows first southerly and then westerly by a devious course to the Hudson, entering the latter about one mile north of Schuylerville. It drains a country, the

topography of which is similar to that of the Hoosick river. The profile of the river is steep, especially in the last few miles of its course. As a result of this, there are a number of water powers along the river, especially along the lower section.

4. The Sacandaga river, the largest tributary of the Upper Hudson, which enters from the west at Hadley, has a drainage area of 1,040 square miles. At its headwaters the river is formed by the union of three branches, each of which form outlets to lakes situated in the southwestern part of Hamilton county. The west branch forms the outlet of Piseco lake, having an elevation of 1,648 feet; the middle branch the outlet of Sacandaga lake, having an elevation of 1,706 feet, and the east branch the outlet of Pleasant lakes, a series of small lakes in the western part of Warren county, having elevations ranging from 1,600 to 2,000 feet. After these three branches unite, the river flows in a southeasterly direction to a point about five miles below Northville, where it turns abruptly to the northeast and follows this direction in an irregular course to the Hudson river.

Although the profile of Sacandaga river is steep and affords good opportunities for water power, these powers have not up to this time been developed, except in two or three cases. The country drained is a mountainous one, very sparsely settled.

5. The Schroon river is the last important tributary, entering the Hudson river from the east and north, having a drainage area of 560 square miles. This river forms the outlet of a number of lakes on the southern slope of the highest portion of the Adirondack mountains in Essex county. The elevations of some of these lakes range from 1,000 to 1,500 feet above sea level. The river flows southerly through Essex and Warren counties and enters the Hudson just above Thurman. Although this stream also affords opportunities for water power development, the only power that has been developed is by the Schroon River Pulp & Paper Company below Warrensburg.

The remaining two tributaries of the Upper Hudson river are Boreas river and Indian river. Both streams have relatively small drainage areas and since there are no developed water powers along them, and only a small resident population, they will not be described in detail.

Geology and Hydrology of the Upper Hudson

The geology of the Upper Hudson river basin is very complicated, and since its importance in the present investigation is mainly in relation to its effect upon stream flow, it will be described only to the extent of showing this relation.

The Upper Hudson drains a rugged mountainous region lying between the Adirondack mountains on the west and north and the Green mountains on the east. This region is one of the oldest in the geological formation of the State. In the early Paleozoic period the lower areas of this basin were submerged, the Adirondack mountains forming an island in the Paleozoic sea which covered the remaining area of the State. During subsequent upheaval and subsidences this region was successively subjected to denudations, while the system of folding and erosion which followed gave rise to the rugged topography, the numerous lakes forming the sources of many of the tributaries, and the character of the outcrops of rock of the various geological characters or periods, seen at the present time.

In the western and northern portions of the basin the river and tributaries flow over a formation of Precambrian gneiss and limestone which form the steeper slopes, while in the valleys between these slopes are found extensive areas of sand, frequently of considerable depth. In the eastern portion of the basin, extending into the Green mountains of Vermont and Massachusetts, these tributaries flow over formations of limestone, shale and sandstone.

The influence of the topography and surface geology, as well as the condition of forestry upon the Hudson river catchment, has an appreciable effect upon the volume of flow of the river. From the steep and impervious slopes of the upper mountain sections, the rainfall, except the small portion which is absorbed by the ground, runs quickly to the streams and either flows off at once or is retained as temporary storage in the lakes or ponds. On the sand areas the rainfall is mostly absorbed and stored in the sand, from which it flows beneath the surface gradually to the stream. The forest vegetation, including the extensive growths of what the woodmen call " spruce duff " (a sponge-like growth), has the effect of temporarily absorbing and storing the rainfall, releasing it gradually to the streams.

Owing to the equalizing effects which the relatively large amount of temporary storage from the lakes, sand areas and vegetation have upon the run-off of the Upper Hudson catchment, the flow is well maintained through the year, especially during the summer season, when other catchment areas of similar size, but lacking this storage, yield a much smaller flow. A record of the flow of the Hudson river over the West Virginia Pulp & Paper Company's dam at Mechanicville has, very fortunately, been kept for a number of years, and from this record the flow from the catchment area above this point can be readily compared for the various seasons and years.

This record of flow, covering the period from 1890 to 1906, inclusive, is given in Table No. 1, Appendix A. This table gives the average monthly flow for each of the years of this period, as well as the average of the monthly flows for the whole period. The flows are expressed in cubic feet per second.

Assuming the period of "summer flow" to be represented by the months of July, August and September, the three lowest monthly flows shown in the column of averages, and taking the average of these three months as representing this period, we have 4,367 cubic feet per second as the "average summer flow." Selecting the year 1899 as representing a year of minimum summer flow, and taking the average of the three months as before, we have 1,913 cubic feet per second as representing the "minimum summer flow." The lowest flow recorded for any month during this period was 1,393 cubic feet per second, occurring in August, 1899, which may be considered as representing the "minimum monthly flow."

In order to compare the condition of flow of the Hudson river during the short interval of time covering the field examinations and analytical work during the present investigation with the flow at other seasons or periods, as just described in the above table, I have secured the records of flow at Mechanicville for each day from June 12th to June 30th, inclusive, the interval covered by these observations. This record of flow appears in the Table No. 2, Appendix A.

Taking the average of the flows given in Table No. 2 as representing an appropriate comparison with the monthly flows as expressed in Table No. 1, it will be seen that the stage of the river at the time of our observations corresponds very closely to the " average summer flow," covering the period of years included in Table No. 1. Expressed differently, the condition of flow of the river during the time covered by our observations corresponds to the *average summer conditions* that might be expected during any period of fifteen consecutive years.

II. POLLUTION OF THE UPPER HUDSON RIVER BY INDUSTRIAL WASTES

(a) *Character of Industrial Wastes*

The pollution of the Upper Hudson river by the mills and industrial establishments which were examined and studied in this investigation comprises wastes or by-products from the various processes employed in pulp and paper mills, knitting mills, tanneries, creameries, breweries and distilleries, wall-paper and other printing mills and woolen mills. There are other industrial establishments than these located along the Hudson river in the territory covered, but it was found that the wastes were of such a character or in such small quantities as to be an insignificant factor in the general pollution of the river.

The mills which cause the most serious pollution of the Hudson river and tributaries and the ones which form the basis of complaint of the petitioners are the pulp and paper mills. A most thorough examination was made of them on this account.

Tanneries are in general a source of serious pollution wherever they exist, if the wastes are not purified. On the Upper Hudson watershed, however, there is only one tannery, viz., at Ballston Spa, and although this tannery has in the past been a source of serious nuisance and a cause for special investigation, the wastes are at present being purified by treatment in precipitation tanks before they are discharged into the village sewer system.

The knitting mills are few in number and the wastes discharged by them into the river not found to be a serious factor in the general pollution of the river. They do discharge a small amount of soap, and some aniline dyes and salts which are used in the manufacturing processes. The knitting mills are located principally upon the Batten kill and the Hudson below the Batten kill. No purification processes were used in any of the knitting mills that were inspected.

Creameries, breweries and distilleries were not found to be appreciable factors in the pollution of the Upper Hudson. There were no distilleries and only one brewery — located at Fort Edward. No creameries, where butter or cheese is manufactured, were found, although five milk stations were located. The wastes from these, *i. e.*, the washings of milk cans and a small amount of wasted milk in the summer season, were found to be so small and the amounts so indefinite of estimation that no attempt was made to include them in the statistics and tables appearing later in the report.

Wall-paper mills and cotton print mills that do printing furnish a considerable amount of pollution, not so much on account of the quantity as the character of it. The wastes are mostly spent color-washings from the printing machines which, when discharged into the streams, are very unsightly. Wall-paper and print mills were found principally along the Hudson river and along the Hoosick river in Massachusetts.

Woolen mills are nearly always sources of objectionable pollution. The waste water from the wool scouring machines carries large amounts of animal grease and soap, while, in the mills where the wool is dyed, there is in addition a considerable amount of spent dyes. The only woolen mills were found to be situated almost exclusively on the Hoosick river in Massachusetts and Vermont.

It should be stated here that in all of the mills some provision is made for the disposal of the sanitary sewage of the employees. In some instances this sewage is discharged into the streams along with the industrial wastes, and in some instances it is discharged independently into public or private sewer systems or directly into the river. The sanitary sewage from these mills, however, represents in amount but a very small fraction of the industrial wastes, and although in quality it is of considerably greater importance from the standpoint of affecting health and life than the industrial wastes, I have disregarded it here in connection with the industrial wastes, leaving it to be considered later in the report under the general subject of domestic sewage.

(*b*) *Processes Employed in the Various Mills*

Having described in a general way the different kinds of industrial establishments found along the Upper Hudson and its tributaries, and the extent to which our examination of them was carried, there will now be described in detail the various manufacturing processes employed in these mills and the nature and amounts of the waste products resulting from them that are discharged into the streams.

PULP MILLS

There are two distinct processes in manufacture of paper, viz., the manufacture of wood pulp and the manufacture of paper from this pulp. In the manufacture of wood pulp in the mills examined during this investigation three general processes are used:

(1) Chemical fibre or soda ash process.
(2) Sulphite of lime process with sulphite liquor prepared by
  (*a*) Passing sulphur fumes through solution of lime water.
  (*b*) Passing sulphur fumes through lime rock in towers.
(3) Ground wood process.

In the manufacture of paper the processes used were practically the same in the different mills and were independent of the method used in manufacturing the pulp.

In all these processes of pulp and paper manufacture there are certain wastes or by-products to be disposed of, and since, at the time of this investigation these were being discharged into the Hudson river or its tributaries, a detailed description will be given, not only of each of the processes, but of the general character and amounts of the various wastes resulting from each. In all of the mills where pulp is manufactured the bark is first removed from the wood before it is subjected to treatment.

Chemical Fibre or Soda Ash Process

In the chemical fibre process the barked wood, which, in the case of the only mill using this process was poplar, is chipped and run into circular digestors or tanks seven feet in diameter and twenty-four feet high and cooked in a solution of soda ash and lime for about six hours. During this cooking the gums. oils and resins are dissolved from the wood, leaving the insoluble fibre or wood "pulp." After cooking, the contents of the digestors are blown into washing tanks where the caustic solution is drained off, leaving behind the pulp stock. The caustic solution is later treated by evaporation and burning to recover the valuable soda ash to be used again in the process, the loss of soda ash during this recovery process being made up by the addition of new soda ash. The pulp which remains is then washed thoroughly by rotary screens and delivered to the bleaching tanks, where the final process preparatory to the manufacture of paper is carried out.

The wood pulp is bleached by means of chlorinated lime or bleaching powder. The pulp is treated with a clear portion of this chemical in tanks through which the mixture is successively passed. The pulp after being so treated is again washed and is stored ready for use in the manufacture of paper.

In the soda ash process there are three classes of wastes, as follows:

1. The "lime sludge" precipitated as carbonate of soda in the tanks in which the soda ash is treated with lime. The amount of this waste approximates 1,500 pounds per ton of pulp manufactured.
2. The waste from the soda ash recovery process, which is a precipitate from the tanks where the burnt soda ash is dissolved. The amount of this waste varies considerably and is difficult to estimate. It will, however, approximate 1,000 pounds per ton of pulp manufactured.
3. The bleach sludge precipitated from chlorinated lime tanks as slaked lime and other insoluble materials. These wastes approximate 200 pounds per ton of pulp manufactured.

Sulphite Process

In the sulphite process the wood, spruce, is chipped and delivered into circular tanks or digestors as in the other process and there cooked with the sulphite liquor. This liquor is prepared by passing fumes of burning sulphur by a vacuum process through lime water or upward through towers stacked with limestone or marble, the sulphurous acid and lime uniting to form bisulphite of lime. During the cooking the wood fibre is loosened and separated from the lignin and other encrusting constituents of the wood, and the fibre is liberated as "pulp." The contents of these digestors are then blown into washing tanks where the pulp is washed and thoroughly drained on screens. The pulp is then screened, either without further treatment or after first bleaching with chlorinated lime, for the manufacture of paper.

In the sulphite process the only waste important enough to be considered is the sulphite liquor which is drained from the blow pits into which the contents of the digestors are first discharged. This liquor is a heavy, transparent liquid of reddish brown or coffee color, the principal constituents of which are the dissolved portions of the wood, the sulphite of lime and the unrecovered sulphurous acid with which it is in combination. In addition to this liquor there is a small quantity of wood pulp that escapes during the process of washing the pulp.

In order to estimate the amount of sulphur, lime and decomposed woody waste, the average figures have been taken, furnished by the different mills, of 1,250 pounds of pulp recovered per cord of wood. With the weight of air-dried spruce wood at 2,750 pounds per cord we have the difference of 1,500 pounds of digested wood that is carried off in the waste sulphite liquor per cord of wood. This is equivalent to 2,500 pounds of wood waste per ton of pulp manufactured. The amounts of sulphur and lime discharged with the sulphite liquor will approximate the original amounts used to make the sulphite liquor, since practically none is taken up by the pulp prepared in the process and since this pulp is washed of practically all the sulphite liquor before it is used in the manufacture of paper. Since approximately 250 pounds of sulphur and 175 pounds of lime are used for every ton of pulp manufactured, these quantities represent directly the amounts of sulphur and lime as waste products per ton of pulp manufactured.

Ground Wood Process

In this process the barked wood, instead of being chipped, as in the other processes, is cut into short logs about two feet in length and ground in steam presses against revolving stones. The pulp so ground is then carefully screened and run directly to the paper machines or to the "wet rolls," where it is prepared into sheets, folded and stored for future use or for shipment.

In this process the waste consists of the fine pulp fibre contained in the "white water" from the screens of "Decker machines" or from the "wet machines." This fibre is very fine and the amount wasted is considerable and variable. The variation results from a difference in the amount of the white water which the different mills use again for transporting pulp to the beaters and of the number of "Decker machines" used for recovering the pulp from the "white water." Tests run at the mills of the Union Bag & Paper Company indicate that the amount of fine pulp fibre discharged with the white water into the streams will amount to 10 per cent. or more of the pulp manufactured. Using the lower figure of 10 per cent., we have 200 pounds per ton of pulp manufactured as a general estimate of the fine pulp fibre wasted and discharged into the streams from the ground wood process.

Paper Manufacturing Process

The pulp before it is passed upon the paper rolls is, if pressed pulp is used, first passed through beaters, where it is thoroughly beaten until it has reached a proper consistency. In the beaters the necessary chemicals, such as alum, dyes, clay or resin are added to give the paper its proper texture, color and stiffness. The pulp from the beaters is then pumped to the paper machine rolls, where, after running over revolving screens through which the surplus water is drained, it passes over the steam rolls and is pressed into paper.

The wastes in the paper process are from the horizontal screens where the pulp is drained before delivering onto the rolls. These screens have a "catch all" underneath the forward end which catches much of the water and washings from the pulp. The washings from the "catch all" are returned and used again to dilute the pulp as it comes from the beaters. The washings that are not caught by the "catch all" are usually wasted and discharged into the streams. In some mills attempts are being made to recover a part of these washings, but the amount of recovery was very small.

These washings from the paper machines contain a certain small percentage of the materials or chemicals added during the process of beating, including alum, clay or resin, dyes and pulp. About one-half of the clay used is lost, since it is too fine to be retained by the alum which is used as a coagulent. In fact this clay and a small amount of pulp fibre escaping with it are the only wastes which are discharged in appreciable amounts from this process. The dyes are practically all absorbed by the paper, while the alum is not only practically all retained on the rolls but, as stated above, a retention of about one-half of the clay used is effected by it.

The amount of clay used varies somewhat with the different mills, some not using any. In all cases where it was used, however, it was estimated that approximately 50 per cent. was lost. When paper is manufactured for use in printing about 5 per cent. of clay is usually used. This gives, with a loss of 50 per cent. in passing through the paper rolls, about fifty pounds of clay per ton of pulp manufactured.

It was found that the total loss from the wet machines was about 7½ per cent. Of this loss 2½ per cent. is from the clay, as stated above, leaving 5 per cent. as the estimated loss of pulp fibre where no save-alls or settling tanks are used. This corresponds to 100 pounds of fibre lost per ton of pulp.

A description of each of the pulp and paper mills estimated during this investigation with an estimate, based upon the foregoing data, of the total amount of the different classes of wastes discharged from each is given in Appendix B of this report. Some local variations in the processes of manufacture or recovery of wastes were met with, but, in general, the different mills used quite uniformly similar processes throughout so that no corrections were made.

It should be stated that in addition to the paper and pulp mills included above, there are a few box board and leather board mills. The only wastes from these mills were from the paper rolls, and the amounts were estimated the same as from the paper rolls of the paper mills.

KNITTING MILLS

The wastes from knitting mills come entirely from the processes of fulling and dyeing of the garments. Usually a high grade of wool and cotton is used in the manufacture of the garments so that there is only a comparatively limited amount of grease and fibre discharged with the wash water. The soap, the dyes and the salts used as mordants constitute the remainder of the waste products from these mills.

While there were found to be some variations in the quality of goods used in the different mills and of the colors used in dyeing, it is estimated that on the average about five pounds of soap and two pounds of wool grease per 100 pounds, or five dozen pieces of finished stock appears as wastes from the process of filling, and about .00025 pounds of spent dyes, and from five to ten pounds of salts per 100 pounds, or five dozen pieces of finished stock appear as wastes from the process of dyeing.

The names and locations of the various knitting mills found and inspected, together with general statistics respecting the number of employees, daily output of finished product and the estimated amounts of different classes of wastes discharged into the stream are given also in Appendix B, under the heading of "Knitting Mills." The data given in the preceding paragraph was used as a basis for these estimates, and owing to the similarity of conditions found in the various mills no variations from these figures were found necessary.

In addition to the knitting mills in this list, there were two or three knitting mills that do no washing or dyeing whatever, and these were omitted from the tables. There were also a few other mills in which twine and thread were manufactured, and since the wastes from them resulted from dyeing and washing operations and were similar in amounts to the same materials discharged from the processes of washing and dyeing in the knitting mills, they were included in the tables.

WOOLEN MILLS

The wastes from woolen mills are a source of considerable and objectionable kind of pollution. These wastes result from two processes; one from the scouring of the wool, and the other from the dyeing of the wool when this is done.

In the scouring of wool there is in general about ten pounds of soap and from three to five pounds of alkali used per piece of woolen cloth manufactured. These chemicals, together with the animal grease, are all discharged with the wash water. The loss in weight of the raw wool, amounting to from 40 per cent. to 60 per cent., consists chiefly of animal grease, but includes also considerable dirt and small fibre.

Where the woolens are also dyed, the amount of spent dyes and salts appearing as waste is considerably more than from knitting mills, owing to the use of much heavier and stronger dyes in this class of goods. The spent dyes and salts discharged from woolen mills is quite variable, but will generally range from 0.1 pounds to 0.3 pounds of dyes, and about two pounds of salts per piece of woolen cloth manufactured.

A list of the woolen mills with their location and general statistics with reference to output, number of employees and estimated amounts of different classes of wastes discharged from them into the streams is also given in Appendix B, under the heading of "Woolen Mills." Since these mills were nearly all located in Massachusetts and Vermont and hence outside of the jurisdiction of this Department, it was impossible to secure the desired detailed information with respect to them. The figures for the amounts of wastes given in the above-mentioned list are consequently only general approximations, but were included in order to complete the statistics, and the tables and diagrams summarizing the same.

WALL-PAPER MILLS

The wall-paper mills on the Upper Hudson were of two kinds. In one of them the colors were printed upon white paper stock manufactured in paper mills. In the other the wall paper was manufactured in the mill from pulp stock, the paper being colored with dyes added to the pulp stock while passing through the beaters.

The wastes from wall-paper printing mills comprise the dyes, clay and glue that are washed periodically from the machine rolls. The "color" used in printing is a mixture of these materials in varying proportions, and since these colors are valuable, only a minimum amount is allowed to be wasted. Although varying somewhat in the different mills and with the different colors used, it is estimated that from six to ten pounds of dyes, 140 pounds of clay and ten pounds of glue are used per ton of paper printed. The actual percentage of these materials wasted through washing could not be estimated with any degree of accuracy, but from the best information available it ranged from ½ of 1 per cent. to 1 per cent., depending principally upon the method and care taken in scraping the rolls and thus curtailing the loss.

In the wall-paper mills in which the paper itself is manufactured the wastes are similar in every way to the wastes from ordinary paper mills where prepared pulp stock is used. The only difference is in the amounts of dyes wasted, which in the case of the wall-paper mills was considerably greater owing to the heavier colors given to the wall papers. It is estimated that from 2 per cent. to 3 per cent. of the dyes used are wasted and discharged into the streams.

In two mills on the Walloomsac river the wastes were partially purified by filtration through coarse gravel, but in the other mills no purification was attempted.

A list of the wall-paper mills with their location and general statistics with reference to output, number of employees and estimated amounts of different classes of wastes discharged into the streams is also given in Appendix B, under the heading of "Wall-Paper Mills."

COTTON-PRINT MILLS

The wastes from cotton print mills are of two kinds When the cloth is dyed prior to printing the wastes will comprise the spent dyes from the vats in which the cloth is dyed. In the process of printing the wastes will consist of the colors wasted in the washing of the printing machines, the same as with the wall-paper mills.

In the case where the goods are first dyed, generally from 2 per cent. to 3 per cent. of the dyes used are lost or discharged as waste. In the printing process about one-quarter pound of anilines and 3.4 pounds of miscellaneous salts and drugs are used per piece of finished goods, of which about ¼ of 1 per cent. is lost in washing operations.

A list of the cotton-print mills with their locations and general statistics with respect to output, number of employees and estimated amounts of different classes of wastes discharged into the streams is given also in Appendix B, under the heading of " Cotton-Print Mills."

(c) *Statistical Summary of Pollution from Industrial Wastes*

In order to present in concise form the pollution of the Hudson river from the various mills and factories, outlined above, the following table (No. 111), Appendix C, has been prepared. This table has been arranged to show in column 1 the name of the mill or industrial establishment; in column 2 the location of the mill; in column 3 the stream on which the mill is located; in column 4 the number of employees; in column 5 the average daily output of the finished product of the mill; in columns 6 to 13 the estimated average daily amount of the different classes of wastes discharged from the individual mills; and columns 14 to 16 the organic, mineral and total wastes respectively from all mills at various selected points along the river.

The various mills in the list are arranged in the order in which they contribute wastes to the Hudson river and its various tributaries; the first mill in the list being the one situated farthest up on the river, and the last mill in the list being the one situated lowest along the river. The totals at the foot of the list give at once the total number of the different classes of wastes discharged into this section of the Upper Hudson river by all of the mills.

In order that this pollution may be seen still more graphically, and in a manner that will admit at a glance a comparison of the pollution at various points along the Hudson river, the data in Table No. III has been arranged in the form of a " mass curve " on diagram No. 1, Appendix C. The ordinates on the diagram represent distances in miles along the Hudson river from its source to its confluence with the Mohawk river. The abscissæ shows the fractional and total amounts of wastes discharged into the river from the mills and factories at the points of confluence of the principal tributaries, and at other important points along the river.

The lines on either side of the vertical axis show, with respect to wastes; first, the total organic waste, secondly, the total mineral wastes; thirdly, the total of all wastes; fourthly, the total wastes in pounds per square mile of drainage area. The latter quantity or unit represents the intensity of pollution since the flow of the river is approximately proportional to the drainage area. Further, since the average summer flow of the river is approximately one foot per second per square mile, the line or curve of drainage area in square miles represents very closely this summer flow in cubic feet per second.

These curves are plotted to different scales in order to have the diagram of convenient size and sufficiently close to one another to afford a ready comparison — the scales corresponding to the different lines being shown at the bottom of the diagram. These differences in scales should be carefully kept in mind since the curves as they appear bear no relation to one another except as to form.

The diagram shows then, at a glance, a comparison of the total amount of industrial pollution of the Hudson river at the various points along its course from the two important classes of wastes, the organic which is more or less subject to decomposition, and the mineral matter which is nondecomposable. These curves will be further discussed in the following pages under a more general heading of effects of pollution of the Hudson river by industrial wastes.

III. POLLUTION OF THE HUDSON RIVER BY DOMESTIC SEWAGE

(a) *Pollution by Urban and Rural Population*

Of considerable importance with respect to comfort and convenience and of vastly greater importance with respect to health and life of citizens who reside along the Hudson river and who, in many cases, use the water for domestic purposes, is the pollution of the river from domestic or sanitary sewage. By this is meant the sewage derived from water used for domestic purposes and containing human wastes that may be of an infectious origin. The importance of this class of sewage from a sanitary standpoint is at once evident.

In general this domestic sewage may reach the streams in two ways. It may be discharged directly into the stream from sewerage systems of cities and villages situated upon the river, or from vaults or privies constructed directly over the stream. Again the sewage may reach the stream after it has been percolated through the soil or flowed over the ground, *i. e.*, from cesspools, privies and other waste heaps, not located directly upon the stream, but from which the washings leach through or over the soil to the stream. The sewage in the former case, from the urban population, is considerably greater in volume, and is derived principally from the urban population resident in the cities and villages situated directly upon the river. The sewage in the latter case, or from the rural population, is derived in a large measure from the population residing outside of the urban districts, and also from the population within the cities and villages that either have no sewerage system or who are not connected with such a system in case one exists.

(*b*) *Statistical Summary of Pollution from Domestic Sewage*

In order to determine the amount of the domestic sewage reaching the Hudson river, statistics were gathered from the various municipalities and townships which would show the relative populations contributing either directly or indirectly to the streams. The data secured was naturally somewhat approximate, since many of the villages have no established sewer system, but rely upon old private sewers, the number of persons connected with which was not accurately known. Again, in some of the villages where modern systems have been built and were in operation, no accurate records have been kept of the numbers of persons or houses connected with the sewers.

Notwithstanding that the statistics are approximate, they are nevertheless valuable, and the following tables, No. IV and No. V, Appendix D, are presented to show the population, both urban and rural, which discharge sewage either directly or indirectly into the waters of the Upper Hudson river. Table No. IV gives a list of the municipalities having public or private sewers, column 1 of the table gives the name of the municipality; column 2, the total population; column 3, description of the kind of sewer; column 4, the estimated population contributing sewage; column 5, the stream into which the sewers discharge. Table No. V gives these and other statistics with respect to pollution of the Hudson river at various points along its course, arranged somewhat differently for means of comparison.

In Table No. V, column 1 gives the location of these selected points on the river; column 2, the distance from the source of the Hudson river; column 3, the drainage area of the Hudson river above the points stated in column 1; column 4, the total population upon the watershed above the points stated in column 1; column 5, the population connected with sewers discharging directly into the Hudson river, to which has been added an estimated amount of from 2 per cent. to 5 per cent. of the population not so directly connected with sewers, in order to allow for private drains, privies and vaults connecting directly with the streams; column 6, the per cent. of population contributing sewage to the total population on the drainage area; column 7, the total population per square mile of watershed; column 8, the average number flow of the Hudson river in cubic feet per second; column 9, the corresponding flow per 1,000 of population contributing sewage to the river; and column 10, the population contributing sewage per square mile of the watershed. The flow per 1,000 population is the unit usually adopted for comparing sewage pollution by the dilution method.

In order to show the extent of this pollution more clearly and in a comparative way with respect to different sections along the river, as well as the intensity of pollution with respect to its dilution, diagram No. II, Appendix D, is presented. This diagram was constructed in a manner similar to portions of diagram No. I, Appendix C, for industrial wastes, ordinates representing distances along the river from its source and abscissæ representing drainage areas, total population upon the watershed, populations contributing sewage and other statistics showing the total and relative pollution of the river and its main tributaries by domestic sewage from the urban and rural population upon the watershed.

These tables and diagrams will be further discussed later in the report under the more general heading of effects of pollution of the Hudson river by domestic sewage.

IV. CHEMICAL AND BACTERIOLOGICAL ANALYSIS OF HUDSON RIVER WATER

When any body of water or river like that of the Hudson receives pollution in sufficient amounts not to be obscured by natural dilution, or by influences of sedimentation, stratification or otherwise, it may in general be best studied by chemical or biological methods. Such studies, however, to be most effective should be continued over a considerable period of time, with samples analyzed at intervals of weeks or months during the period. Although this was not practicable in the present investigation, it was decided, for the purpose of a confirmatory comparison with our other observations, to make one rather complete set of analyses of the Hudson river water taken from sampling stations selected with respect to principal points of pollution.

The sampling stations are indicated upon the general map accompanying the report. They were so selected as to bring out in a comparative way the pollution at various points along or sections of the river. Thus with the Hudson river and with its main tributaries a station was first selected above all pollution. Then, coming down the river, other stations were selected just below these mills or groups of mills, and again just below these mills at a sufficient distance to insure a uniform mixing of the sewage with the river water. In this manner it is possible to compare directly the effect of the pollution upon the chemical quality of the water and at the same time to compare the changes in the quality of the water in its travel down stream due to the combined influences of dilution, sedimentation and oxidation.

In order to make the comparison of the pollution of the river more complete three additional sample stations were selected near the confluence of the Hudson and Mohawk; one on the Mohawk above the junction and two on the main river below the junction, opposite Troy and Albany respectively. With these additional stations a comparison of the quality between these two important tributaries of the lower Hudson can be made as well as a comparison of the Hudson river in the short section from the Mohawk to Albany, the most polluted section of the river above New York.

In case there was any evidence or suspicion that the sample taken from the river at any section should not, by reason of horizontal stratification, be representative of the entire cross section of the river, a composite sample was taken. This composite sample was made up by taking fractional portions of the entire sample from different points across the stream. That is, if a two litre sample were collected at any section of the river, it was made up of four samples taken at four equidistant points across the river. The whole sample could then be considered as representing appropriately the river water at this section. In some cases the composite samples consisted of two portions and in other cases as many as four or five portions.

Since the object of making these analyses was more for purposes of a comparison of the intensity of pollution rather than a confirmation of evidence of pollution, and in order that the analytical work could be performed in as short a time as possible to avoid any disturbance from a varying flow of the river, these analyses were limited to a determination of free ammonia, albuminoid ammonia, nitrates, chlorine, oxygen consumed (both thirty and five minute boiling) and dissolved oxygen. Nitrites, total nitrogen and other determinations usually included in a complete analyses were not, for the reasons stated above, considered necessary.

The results of these analyses are given in the following table No. VI, Appendix E. The results of the chemical analyses are expressed in parts per 1,000,000 and the bacteriological determinations in numbers per cubic centimeter. The general arrangement of the table and the notes attached make the table self-explanatory. A further discussion of the results of these analyses will be given later in the report.

V. DISCUSSION OF THE EXTENT AND EFFECT OF THE POLLUTION OF THE HUDSON RIVER

(a) *Extent of Pollution*

In general we may say that the Hudson river and its tributaries in the counties of Washi[illegible] W[illegible]en and Saratoga are polluted by the wastes or refuse from some sixty-five (65) pulp and paper mills, knitting mills, tanneries, woolen mills, wall-paper mills and cotton print mills, and by the domestic sewage from some twenty-one (21) villages and cities comprising an urban population of about 79,000 discharging directly in the streams. In addition to this pollution there is a rural population of about 144,000 upon the watershed, the domestic sewage from which ultimately reaches the river after being more or less completely purified by natural processes in passing through and over the soil. Considering, however, the sparseness of the population and the complete purification which takes place when sewage passes through soil, this latter pollution, outside of occasional surface washing, can, from a sanitary standpoint, be disregarded.

(1) POLLUTION BY INDUSTRIAL WASTES.

Taking up now in detail the pollution from mills or industrial establishments that discharge their wastes into the Hudson river, we find in general that this pollution is confined principally to the main river and its three branches, the Batten kill, Fish creek and Hoosick river. The pollution on these streams will be described separately.

Hudson River

The first mill which discharges wastes into the Hudson river is the Schroon river pulp mill, using the ground wood process, located just below Warrensburg.

This mill is in reality on the Schroon river but it is so near the confluence with the Hudson river that it has been for convenience grouped with the Hudson river mills. Both the Schroon and the Hudson rivers above Warrensburg are practically unpolluted by industrial wastes. Since the wastes discharged into the river by the Schroon River Pulp and Paper Mill is small compared with the volume of flow of the river, and since the waste from the ground wood process is not rapidly decomposable, there is practically no evidence of any pollution of the river a short distance below the mill, either chemically or by aid of the senses.

The next mill is the Union Bag & Paper Company mill at

Hadley, some ten miles below, which uses the ground wood process. The waste discharge here is so small and the dilution just below the mill, resulting from the affluence of the Sacandaga river, is again so great that no evidence of its pollution could be detected below the junction of the two streams.

The next mill is at Corinth. This is a large mill and an important one in respect to the pollution of the river. Here the output is large, the wastes correspondingly large and the sulphite process which is used for making about one-half of the total pulp manufactured by this mill, all unite to give to the river its first significant increment of industrial pollution. The appearance of the river just below the mill clearly shows the serious amount and character of this pollution. Owing, however, to the relatively large volume of pure river water charged with oxygen, in which these wastes are diluted, the pollution below the mill cannot be traced for any considerable distance. This is shown by a comparison of the sample taken one-quarter mile below the mill with a weighted average of the two samples of the Hudson and Sacandaga rivers above their confluence where they are practically unpolluted.

By the time the water reaches Glens Falls there is no visible evidence of pollution outside of that caused locally at this time by sawdust from the saw mill just above this point, and very little evidence from the chemical analyses except in the oxygen consumed, which shows the presence of carbonaceous matter of a slowly decomposable nature. In fact it is only the great dilution by, and large amount of, dissolved oxygen carried in the river water that accounts for such small evidence of pollution at Glens Falls, so short a distance below this mill at Corinth. The loss of dissolved oxygen in the water in its passage from Corinth to Glens Falls shows the price paid for this recovery.

At Glens Falls the pollution on the main stream begins to be more serious and in the short section of the river from Glens Falls to Fort Edward, as much industrial pollution is added as comes from all other sources on the watershed above the Mohawk river. The two ground wood mills of the Finch, Pruyn & Company and the International Paper Company at Glens Falls, the four mills of the Union Bag & Paper Company at Sandy Hill, one of which uses the sulphite process, and the mill of the International Paper Company at Fort Edward, using also the sulphite process, all unite to give to the river a dose of industrial pollution from which it does not fully recover even as far down as the Hoosick river and notwithstanding the relatively smaller amount of pollution added to the river in this distance.

From Glens Falls to Fort Edward the increase in the pollution is plainly visible. Below Glens Falls the slight discoloration of the water and the suspended pulp can be traced in the water itself with the eye for a short distance and then by the deposits of fine pulp upon the stones and plants along the submerged banks of the river. Below Sandy Hill these evidences are more pronounced, especially the discolorations, which has now changed to the dark reddish brown of the sulphite liquor, and can be traced for nearly the entire distance to Fort Edward. The dam at Fort Edward has an effect of increasing the sedimentation between Sandy Hill and Fort Edward and whereas this sedimentation eliminates some of the suspended matters, it affords at the same time an opportunity for decomposition during which the oxygen of the water becomes more or less exhausted.

Opposite Fort Edward, where the relative amount of industrial wastes discharged into the river is greater than at any other point along its course, the pollution is still more pronounced. The hydrographic condition of the river at this point makes it very favorable for the creation of an insanitary condition and causation of a nuisance. The natural flow of the river for a number of miles below Fort Edward is naturally sluggish and these conditions have been augmented by the construction of a low dam at Crocker's rifts constructed by the State for the purpose of canalizing this section of the river, which raised the water some three and one-half feet at the dam and from one and one-half to two feet at Fort Edward. It is in this sluggish section of the river that the waste products from these ten mills above this point are given an opportunity for a very considerable sedimentation and perhaps at times putrefaction. At the time of our inspection, however, no odors were detected from the river itself although odors from the sulphite mills at Fort Edward and Sandy Hill were easily detected in the path of the wind for a distance of more than two miles and were claimed by many persons to be detected for distances of over ten miles.

The river below the dam is divided by an island some one-quarter mile wide and one and one-half miles in length, separating it into two nearly equal channels. Since the wastes from the mills at Fort Edward are discharged below the dam on the east bank of the river, the pollution in the easterly channel is very much greater than in the westerly channel.

In this easterly channel, which is adjacent to the densely populated section of Fort Edward, we find the water highly colored with suspended matter, and the bed and banks of the river almost completely covered with a matting of partially decomposed pulp ranging from two to six inches in depth. In the west channel the conditions, though similar, are not so bad, the color, turbidity and sediment being, so far as could be estimated by the eye, about one-half of that in the easterly channel. The high free ammonia, albuminoid ammonia and oxygen consumed of the chemical analyses clearly indicates the excessive pollution of the river at this point and the relatively higher pollution in the east channel.

The sulphite liquor discharged fresh from the digestors has a clear reddish brown or coffee color and this color is imparted to the water in the river. Later this color changes to a dark brown or black, as a result of oxidation of sulphur compounds. In the fresh strong sulphite liquor the sulphur and lime are in rather complex combination with the lignin and other wood constituents, but when this liquor is diluted by discharge into the river these compounds of sulphur and lime become insoluble and form precipitates which have a tendency to throw down any suspended matter in the water, such as the finely divided pulp. It is this process of precipitation that caused the matting of pulp so plainly visible along the bed and banks of the river.

Although the sulphite liquor is an antiseptic and probably a germicide when freshly discharged, it probably loses these qualities very quickly upon dilution. As a result of the aseptic condition of these wastes when freshly discharged, and the naturally slow decomposition of the woody materials, it is probable that any putrefaction which occurs does not take place immediately below the point of discharge but further down the stream, and that the putrefaction, when it does take place, must necessarily be a very slow process. In fact, this is evidenced by the lack of any color from the stream below Fort Edward at the time of our inspection notwithstanding the visual pollution, and further, by the relatively slow oxidation in the section of this river from Fort Edward as indicated by the chemical analyses.

As we examine down the river from Fort Edward, then, we note a slowly progressive change in condition. The clear brown color of the sulphite liquor becomes darker, gradually disappearing by precipitation of the coloring compound. The fine suspended matter in the water from the pulp fibres partially disappears through sedimentation, and the remaining portion collects, through coagulation, forming coarser suspended matter. This condition is further augmented by the presence of large masses of pulp, ranging from a few cubic inches to a cubic foot in volume, that have accumulated upon weeds and brush along the banks and become detached and float down the river.

As we pass further down the river the deposit or matting of pulp fibre and chemicals on the bottom and banks of the river becomes gradually less and its color gradually darker, but it is plainly visible as far as the dam at Crockers Rifts and for a considerable distance below this dam. Below this dam the deposit is black, resembling black peat, but by careful rinsing the pulp fibre can, however, be easily separated and distinguished.

By the time the water reaches Schuylerville and before it receives additional wastes from the mills at Schuylerville, and the sewage and wastes from Fish creek, a slight improvement has taken place in the appearance and quality of the water, as a result of dilution, oxidation and sedimentation. Its quality has improved, notwithstanding the wastes discharged by other smaller establishments along this section of the river and this is due more especially to the added flow of the Batten kill, the water of which, notwithstanding the few mills located on it, is very much purer than the water of the Hudson river.

Below Schuylerville the analyses and appearance of the water show only a slight change in its quality until we reach Stillwater, although the slow oxidation that must be taking place is shown by the reduction of the dissolved oxygen — probably just enough to counterbalance the amount of sewage and wastes discharged into the river along this section. This condition we should expect since there is but a slight pollution from the mills near Schuylerville and, as shown by the analyses, the quality of the water of Fish creek as it enters the Hudson is, with the exception of free ammonia, not very different from that of the Hudson river.

Below Stillwater a considerable amount of pollution is added, mainly from the mills on the Hoosick river and the mills at Stillwater and Mechanicville. The mills along the Hoosick are many and they discharge a considerable amount of wastes into the river but since these mills are situated principally along the upper reaches of the river in the States of Vermont and Massachusetts, there is ample opportunity for oxidation and precipitation which, together with the dilution from tributaries entering the Hoosick west of the State line, so improves the quality that as it enters the Hudson it shows less pollution than the Hudson river water. As a result of this the water of the Hudson river about one mile below the Hoosick river shows an improvement chemically, although just below the pulp mill at Mechanicville, and before the waste from this mill has had an opportunity to be thoroughly dispersed, and the suspended matters have had an opportunity to settle out, the appearance of the water does not seem to indicate this improvement.

Between Mechanicville and Waterford practically no wastes are discharged into the river and very little change in the appearance and chemical quality of the water takes place in flowing this distance. The slight differences that are evident in the chemical analyses merely indicate the changes that might be expected in the organic matter as the river flows from Mechanicville to Waterford.

Below Waterford the Hudson river unites with the Mohawk river so that Waterford marks the lowest point of pollution on the upper Hudson. The wastes from the mills at Waterford, Cohoes and Lansingburgh and from the mills along the Mohawk river above Cohoes are added to the river at this point and in order that comparisons may be made of the pollution of these two large tributaries above their junction and below their confluence additional samples were taken on the Mohawk above Cohoes and on the Hudson above and below Troy. The Mohawk is known to be seriously polluted and although at this time statistics of industrial pollution are not available for the Mohawk, the chemical and bacteriological analyses indicate by the ammonia, oxygen consumed and chlorine, that the pollution of the Mohawk river is more from the domestic sewage discharged into it than from industrial sewage, and that the quality of its water with respect to industrial waste is very much better than that of the upper Hudson at this point. In fact, the quality of the Hudson river below the Mohawk shows a decided improvement with respect to pollution by industrial wastes, owing to the addition of the flow of the less polluted Mohawk.

The analysis of the samples taken just above Albany indicates the serious pollution of the river after the industrial and domestic sewage from Cohoes, Troy and Watervliet has been added to it. The increase in ammonia, oxygen consumed, chlorine and bacteria and the decrease in the dissolved oxygen show, however, that this pollution is again due more especially to the domestic sewage which is discharged into the river from the population of these cities than from their industrial wastes.

Batten Kill

The pollution of the Batten kill by industrial wastes is limited principally to the wastes from a number of small ground wood pulp and paper mills, all located at or below Battenville. Although the total wastes from those mills is relatvely small the pollution is appreciable. Owing to the fact that these mills are small, however, and well scattered along the course of the stream, and the fall of the stream is very great, the visual evidences of pollution were slight.

The Batten kill above Battenville, as indicated by appearances and chemical analysis, is practically unpolluted. The analysis of the water just before its confluence with the Hudson river indicates clearly, however, the pollution that has been added by these mills. The analysis further shows, however, that the water at the Batten kill is much purer than the Hudson river water at this point, and that its general purity assists in improving the quality of the Hudson river water.

Kayaderosseras Creek and Fish Creek

Owing to the unusual hydrology of these two watercourses, forming the natural source and outlet of Saratoga lake, as well as the unusual interest attached to the question of their pollution, which was made the subject of previous special investigation by the Department and a cause for Governor Roosevelt's order against Saratoga Springs for the construction of purification works, our examination of the present condition of pollution of these two streams was rather more completely made than would otherwise have been done. The pollution is almost exclusively limited to Kayaderosseras creek, but the chemical and biological studies were extended to include the Fish creek so that comparisons could be made of the effects of storage and dilution in Saratoga lake and of oxidation and dilution in Fish creek.

As will be seen from the statistics in table No. III and the analyses in table No. V, Kayaderosseras creek above the E. M. Brown Company mills at Rock City Falls is practically unpolluted. As the creek flows from this point toward Saratoga lake it receives industrial wastes from the above-mentioned mill at Rock City Falls, the Pioneer Paper Company and the National Folding Box Company mills at West Milton, and the Union Bag & Paper Company mill at Ballston Spa. Above the mill at Ballston Spa the pollution is not serious, since no pulp is manufactured in the mills above this point, the only wastes entering the stream being from paper machines. At Ballston Spa, however, the large amount of wastes from the sulphite mill of the Union Bag & Paper Company produce a serious pollution of the creek, the drainage area of which is relatively very small. In fact, these industrial wastes and the domestic sewage of Ballston Spa pollute the creek to such a degree that the quality of the water, as shown by the sample below the village, was nothing more than sewage of medium strength.

It should be said, however, that at the time of our examination the new disposal works of Ballston were not in operation. It is expected that these works will be in operation at an early date, when a decided improvement in the condition of the stream should result. It should also be stated, however, that the removal of this domestic sewage will still leave a serious pollution of the creek by pulp and paper mill wastes as long as above-mentioned mills continue to discharge their wastes into the creek.

Below Ballston Spa the creek has a good fall and ample opportunity for oxidation. At Saratoga Springs there are no mills, and since there is in operation a well-constructed sewerage system and sewage disposal plant there is only a small amount of direct pollution which reaches the creek. By the time the water reaches Saratoga lake its quality has, therefore, been greatly improved.

Analyses of Kayaderosseras creek water just before it enters Saratoga lake show that it has been freed of about two-thirds of its matter, although decomposition was still active and the dissolved oxygen was almost exhausted and its appearance was very unsightly. In fact the small amount of dissolved oxygen remaining indicates that when the flow of the stream is slightly less the dissolved oxygen will probably be entirely exhausted and odors will be created as a result of anærobic action.

The Kayaderosseras creek enters Saratoga lake about one mile above the outlet of the lake which forms Fish creek. As the water passes through the lower portion of the lake the natural agencies of dilution, sedimentation and oxidation remove a very large part of the organic and chemical impurities and admit of a large recovery of dissolved oxygen as shown by the analysis of the Fish creek water at the sampling station about two miles below the outlet of the lake.

The waters of Fish creek in its passage from Saratoga Lake to the Hudson, show very little change in quality, as indicated by the analysis of the water above Victory Mills. There is practically no pollution of the stream in this section and the absence of any improvement in quality may be due to the stable condition of the organic matter resulting from the slow passage of the water through the lower portion of the lake. The quality of the water of Fish creek above Victory Mills is not very different from that of the Hudson river at the junction of the two streams.

Hoosick River

The Hoosick river, although the most seriously polluted tributary of the Hudson river with respect to domestic sewage, and considerably polluted by industrial sewage from a large number of mills and factories, does not, on account of the character of these mills, have as large an amount of refuse discharged into it as does the Hudson river from the pulp and paper mills. The mills that do discharge wastes into the Hoosick are located mostly in Vermont and Massachusetts, although a few are within the State of New York. These mills comprise principally woolen mills, cotton-print mills, knitting mills, wall-paper mills and only two small paper mills, and although the total number of these mills is large, the total quantity of wastes discharged from them is not, for the reason above stated.

Since the mills in Massachusetts and Vermont were outside the jurisdiction of this State, it was only through courtesy that any information of the nature and amounts of the wastes discharged by them was secured. In deference also to the request of the millowners, the Department has refrained from giving in table No. III a detailed statement of the wastes discharged by each individual mill, but has given the total amount of each class of waste discharged from all mills in these two States. The general character of the wastes from the individual mills within this State are, however, given.

Table No. III and the analysis of the river water at the New York State line indicates that the Hoosick river at this point, though highly polluted by domestic sewage, is not very seriously polluted by industrial wastes. This is shown by the analysis of the Hoosick at this point, the relatively high ammonias, oxygen consumed and chlorine accounting for the sewage pollution which we know to exist while the fact that there is little if any excess of these constituents indicates that no considerable amount of industrial sewage is present. It should be stated, however, that the flow of the Hoosick river was somewhat above the normal and relatively higher than the flow of the Hudson at the time the samples on the Hoosick river were collected.

From the State line to the Hudson river the Hoosick receives wastes from mills at Walloomsac, North Hoosick, Johnsonville, Valley Falls and Schaghticoke. These mills are not large and are similar to those in Massachusetts and Vermont. The wall-paper mill at Walloomsac purifies the heavier wastes by means of gravel filters, and the mill at North Hoosick is provided with a settling basin in which a large portion of the solid matters is settled out before the wastes are discharged into the river.

Notwithstanding the amount of industrial sewage added to the river below the State line, the quality of the water is not materially changed at the time it reaches the Hudson. The analysis indicates, however, by the slight increase in free ammonia, the slight decrease in albuminoid ammonia and oxygen consumed, and the lower dissolved oxygen that oxidation of the organic matter has taken place and that there has been consequently a slight improvement in the quality of the water. As it enters the Hudson river the general quality of the Hoosick is, from the standpoint of industrial wastes, considerably purer than the Hudson river water.

(2) POLLUTION BY DOMESTIC SEWAGE

The pollution of the Hudson river and its tributaries by the domestic or sanitary sewage of the population resident upon the watershed follows in general the lines of pollution by industrial wastes, though in a much varying degree. This is rather natural owing to the fact that the industrial growth along the river has either followed along lines of increased population, or that these industries have formed nucleii around which the population has developed.

In general one may say that the principal pollution from domestic sewage is confined to the main river below Glens Falls and to the two principal branches, Fish creek and Hoosick river. The main tributaries above Glens Falls, the Batten kill and all of the smaller tributaries are only slightly if at all polluted by domestic sewage, as is clearly shown by table No. V and diagram No. II, which give in detail the total pollution as well as the intensity of pollution at various points along the stream. Since the sanitary effect of sewage pollution is usually proportional to its intensity, as measured by the population per square mile, or the volume of flow of the river corresponding to the unit area, columns 8, 9 and 10 of table V, Appendix D, and the corresponding lines on diagram No. II, Appendix D, give us the best means for this comparison.

Hudson River

From the above table and diagram, then, it will be seen that as we follow the domestic sewage pollution down the Hudson river from its source we find that the main river is practically unpolluted by domestic sewage above the confluence of the Schroon river near Warrensburg. At this junction there is a small amount of sewage added from Warrensburg, an amount too small and too greatly diluted to affect appreciably the chemical or bacteriological quality of the water. Below this point we have additions of sewage at Hadley, Corinth and Palmer but here again the dilution and opportunities for oxidation are so great as not to give any marked increase to the constituents representing this class of pollution. The chlorine and bacteriological determinations, when other classes of sewage are present of a nature to obscure the other determinations, such as from the pulp mills below Corinth, are the best indices of domestic sewage pollution. The chlorines in the samples as far down as Glens Falls follow quite closely the "normal" chlorine taken from the "iso-chlor" map of the region. The bacteria show a decrease in numbers, especially the sedimentation in the mill ponds.

From above Glens Falls to a point below Fort Edward, a distance of only five miles, we see a marked decrease in the amount of sewage added to the river and a corresponding change in the chemical and biological quality. In this short section of the river the sewage from a population of more than 22,000 has been added, increasing the amount present in the river above Glens Falls some ten fold. Although the analytical evidence of this sewage below Fort Edward is largely obscured by the mill wastes, it is nevertheless sufficiently shown by the sudden increase in chlorine and free ammonia, the nitrogenous organic matter of the sewage being much more decomposable than the carbonaceous organic matter from the pulp mills. The marked increase in the nitrogens and oxygen consumed and the decrease in dissolved oxygen are due principally to the very large amounts of organic matter discharged from the mills.

The lower limit of the village of Fort Edward marks the point of maximum intensity of pollution along the Hudson river from domestic sewage as it did with the industrial wastes until the Hoosick river is reached. The sewage from all three villages — Glens Falls, Sandy Hill and Fort Edward, is discharged near the left bank of the river so that below Fort Edward where the channel is divided by an island, the east channel is considerably more polluted than the west channel. This is clearly shown by the two samples taken from these two channels as given in the table.

Below Fort Edward we have very little sewage added until Fish creek is reached, when the added sewage of some five thousand persons, largely purified in passage through Saratoga lake, is added to the stream. It is true that the analysis of the water of Fish creek showed an excessive pollution, but, owing to the small watershed and stream flow, it does not effect any noticeable change in the quality of the Hudson river at this point.

These analyses show that there has been a slight improvement in the quality of the water in flowing from Fort Edward to a point below Schuylerville and Fish creek, as indicated by a decrease in all of the chemical constituents except dissolved oxygen, at the expense of which the improvement by oxidation was partially carried on. In the section of the river from Fort Edward as far down as Stillwater, however, the influences exerted by dilution, sedimentation and oxidation upon the purity of the river water are so complex, and the chemicals which are discharged into the river by the mills are so numerous and variable that it is quite impossible to judge by the analyses alone of the extent of the domestic sewage pollution.

Below Schuylerville there is very little domestic sewage discharged into the river, until we reach the Hoosick river, where the sewage from a relatively large population is added to the river. This sewage is discharged principally into the upper reaches of the Hoosick river east of the New York State line, as shown by tables IV and V, Appendix C, and the analyses show that owing to the great length and steep slope of this section of the river where good opportunities for sedimentation and oxidation are afforded, the quality of the Hoosick river before it enters the Hudson river shows even less pollution than at the State line.

This analysis of the Hoosick river water before it enters the Hudson, however, shows it to be considerably more polluted by domestic sewage than the water of the Hudson river. The chlorine is considerably above the " normal," while the free ammonia and the bacterial counts are also higher. On the other hand, the dissolved oxygen is higher, and the oxygen consumed considerably less than that of the Hudson, but this difference is easily explained by the greater amount of industrial wastes, a large percentage of which is carbonaceous matter, discharged into the Hudson river.

Owing to the large volume of flow of the Hoosick river, there is a marked effect upon the mixture of the two waters below their confluence as shown by the analyses. The albuminoid ammonia, the oxygen consumed, the dissolved oxygen and bacteria of the mixture are intermediate between those of the separate waters before mixing.

Below the Hoosick river the sewage from portions of Mechanicville is added. The amount is small, however, as compared with the total domestic sewage discharged above this point. In fact, the increase in pollution is so small that it cannot be detected by the analyses. The organic matter has increased somewhat, and as shown by the ammonias and oxygen consumed, the decomposition is slightly more active. The higher chlorine is due not so much to the sewage discharged into the river in this section as to the chlorine in the salts discharged from some of the mills at Mechanicville.

A comparison of the domestic sewage pollution of the Upper Hudson with that of the Mohawk river, based on the chemical analysis alone, is difficult to make, owing to the large amounts of industrial organic matter and salts discharged with the industrial wastes into the Upper Hudson. A comparison of the analyses of the two samples taken just above their confluence indicates, however, by the higher ammonias and chlorine in the Mohawk river that the sewage pollution of that river is much greater than that of the Upper Hudson river. The lower bacteria in the

Mohawk river sample, which was collected above the dam at Cohoes, is probably the result of the sedimentation and oxidation that takes place in the large mill ponds formed by the dams on the lower Mohawk, especially those formed by the two dams between Schenectady and Cohoes.

The analyses of the water below the confluence of the two streams, above Troy, show very clearly the effect of the mixture of the two waters, the separate constituents in the sample below the confluence of the rivers being intermediate between the two tributaries above their confluence. The constituents in the sample below the junction of the two rivers are somewhat higher than the average of the two samples collected above, which shows clearly the added pollution from Cohoes and Lansingburgh. The analysis of the water just above Albany shows not only the general serious pollution of the river, but in a striking manner the effect of the sewage added by the city of Troy. The increase in ammonias, oxygen consumed, chlorine and bacteria, and decrease in dissolved oxygen, as compared with analysis above Troy, show clearly the effect which this increased amount of sewage has upon the chemical and biological quality of the river.

Batten Kill

The pollution of this stream by domestic sewage is principally from the employees in the mills and the smaller villages of Greenwich and Salem. There is no visual evidence of this pollution along the stream and any evidence of it deduced from a comparison of the chemical analyses of the two samples taken — one above Battenville and the other below Clarks Mills — should be judged with caution.

The sample below Clark Mills shows high albuminoid ammonia, oxygen consumed, higher bacteria and chlorine, all of which are indications of sewage pollution. This increase in the organic constituents may be, and probably is, due almost entirely to manufacturing wastes. It is known also that chlorine salts are discharged from some of the mills, and this might easily account for the increase in chlorine, especially since the drainage area and the flow of the Batten Kill are not large. In fact, the differences in the analyses of the two samples are not very great and, knowing the statistics with respect to sewage pollution, the differences are, as stated above, easily explained by the industrial wastes.

The water of the Batten Kill as it enters the Hudson river is, then, in general, not badly polluted by domestic sewage and as the analyses show, it is much purer than the water of the Hudson river.

Kayaderosseras Creek and Fish Creek

Kayaderosseras creek in former years when the sewage of Saratoga Springs and Ballston Spa both were discharged into it was a badly polluted stream. At the present time the sewage of Saratoga Springs is very completely purified so that the only domestic sewage now tributary to the stream is from the population of Ballston Spa. The sewage of Ballston Spa will, however, soon be treated at purification works now under construction, at which time the creek will be still further improved. At the time of our examination, however, the new disposal works for Ballston Spa were not in operation so that considerable sewage was being discharged into the creek at this point, as was evidenced by the appearance of the stream and by the chemical analysis of the water below the village.

Above Middle Grove there is practically no pollution from either domestic sewage or industrial wastes as shown by the analysis of the water above the E. M. Brown Company mills. The sample below Ballston Spa shows the stream at this point to be nothing more than a mixture of domestic sewage and manufacturing wastes. The excessive organic matter, chlorine and bacteria is full evidence of the large proportion of domestic sewage derived from the population of this village.

The analysis of the water just before the stream enters Saratoga lake shows that it has been largely purified in its travel from Ballston Spa. The organic matter has been reduced about two-thirds and the bacteria over 95 per cent. In going through Saratoga lake still further purification takes place, so that the water at the upper end of Fish creek shows in a general way less domestic pollution than the Hudson river water into which it flows a few miles below the lake.

Hoosick River

It was previously shown that the Hoosick river, as compared with the Hudson, was not very seriously polluted by industrial wastes, notwithstanding the fact that there are a large number of mills upon the stream, the wastes from which are quite different in character and amount from those upon the Hudson river. With the domestic sewage, however, it is very different for we find a large population upon the Hoosick river and its principal tributary, the Walloomsac, that discharge sewage directly into the stream.

From an inspection of tables IV and V, and diagram II of Appendix D, it will be seen that the sewage of 42,000 persons is discharged into the Hoosick river, and that of this population some 37,000 reside in the States of Vermont and Massachusetts. It is a very significant fact, then, that the amount of domestic sewage discharged into the Hoosick river outside of the State of New York is almost equal (about 90 per cent.) to the total amount of domestic sewage discharged into the Upper Hudson river, including all its tributaries, within the State while the drainage area of the Hoosick river outside of the State is only 11 per cent. of the drainage area of the Upper Hudson river within the State.

The analysis of the Hoosick river water as it enters the State shows a large amount of pollution considering the fact that the stage of flow of the river was, at the time the sample was collected, considerably above the normal. It is, however, difficult to differentiate, in the analyses, the domestic sewage from the industrial wastes. The high ammonias, chlorine and bacteria, and absence of nitrates, are sufficient to account in part for the presence of domestic sewage. The high dissolved oxygen, however, indicates that the water has received considerable aëration in flowing from North Adams, where it receives its greatest pollution, to the New York State line.

The water as it reaches the Hudson river, as shown by the analysis at this point, is slightly more polluted than at the State line, due to the sewage contributed by the villages in New York State. The change in quality is not great, however, since the population of New York State contributing sewage to the

Hoosick river is small as compared with that in the States of Vermont and Massachusetts.

(b) *Effects of Pollution*

In considering the effects which the discharge of industrial wastes and domestic sewage into the upper Hudson river and its tributaries has upon the health and comfort of the inhabitants residing along these streams we must at the outset distinguish sharply between the conditions affecting health and life and those affecting comfort and convenience. The importance of this distinction is much greater with the pollution of the Upper Hudson, as compared with many other streams in the State, owing to the extreme difference in amount of the two classes of pollution. One of these, the industrial wastes, affects almost exclusively public comfort and convenience and has little or no effect upon public health, while the other, the domestic sewage, affects almost exclusively public health and life, and, owing to its relatively small amount, has little effect upon public comfort.

Since these two classes of sewage exert so different an influence upon the comfort and health of the people affected by them, and since the complaints of the petitioners were principally against the industrial wastes and more particularly the pulp mills, the effects produced by the industrial wastes and domestic sewage will be discussed separately.

(1) EFFECT OF POLLUTION BY INDUSTRIAL WASTES

When we consider that the industrial wastes when discharged into the streams do not carry with them the germs of disease and probably very few bacteria at all, and that many of the chemicals discharged with them will have germicidal properties, the effect of these wastes upon health must be very slight. At specific points along the river, however, these wastes carry large quantities of organic matter, the decomposition of which may produce at times odors sufficiently intense to become a nuisance, the offense of which may have a slight effect upon vital resistance. Strictly speaking, however, these odors or other offensive conditions in the river cannot of themselves produce specific diseases.

The extent of the pollution of the river by industrial wastes has been carefully described in detail in the foregoing pages, especially for the section of the river below Fort Edward where the pollution from pulp mills and other industrial establishments was the greatest and below which it existed, to a more or less degree, as far down as the Mohawk river. It was pointed out that there was a marked discoloration of the water, a large amount of suspended matter and floating masses of coagulated pulp and chemicals in the stream, and heavy deposits of pulp and chemicals upon the banks and bed of the stream. These conditions were found to affect in more or less degree the fishing, bathing, boating, the use of the water for drinking, washing, ice supplies and other domestic purposes. No evidence appeared, from our examination, of any effect upon the crops nor upon health and life of cattle or persons. This latter immunity was almost entirely due, however, to the fact that the water was not, on account of its generally objectionable character, used for drinking purposes by either persons or cattle. Inasmuch as the character of the water prevented its use for drinking purposes, the pollution of the river may be said to affect convenience and comfort.

With respect to fishing, the effect of pollution has been to reduce the number and kinds of fish that used to frequent these waters before the pulp mills along the Upper Hudson were constructed. Whether this reduction in quantities of fish is due more to the wastes discharged into the river than to the greater amount of fishing by an increased population is impossible to determine. The wastes from sulphite pulp mills and other industries are, however, known to be highly toxic to fish as shown by the experiments carried out by M. C. Marsh for the U. S. Geological Survey,* and, further, nearly all of the residents along the river below Fort Edward testified to the fact that dead fish are frequently seen floating down the river. In former years bass, mullet, perch and pickerel were caught in abundance, whereas at the present time but very few perch and pickerel are caught and only suckers and eels are in abundance.

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* See Water Supply and Irrigation Bulletin No. 192 on "The Potomac River Basin," 1907.

The effect of pollution upon boating and bathing is principally the discomfort resulting from the general objectionable appearance of the river water, the suspended and floating masses of pulp in the water and the objectionable and at times offensive deposits of pulp and chemicals on the banks and bottom of the stream. This deposit on the bed of the stream is very light and is quickly brought into suspension when stirred with an oar, or by the feet in bathing, and in this respect is objectionable.

The objectionable effect of the pulp mill refuse upon the use of water for domestic purposes results principally from the discoloration and suspended matter, though at times it must have an objectionable taste and odor, the latter especially when heated. The water, on this account, and except when the wells or other sources of water supply are short, is generally not used for drinking or washing purposes. If cut for ice supplies, it is used only for cooling purposes.

The effect of pollution upon crops was found to be very slight, if any. Almost no land was shown that was flooded except for short periods in the spring of the year — a condition easily understood from the hydrographic conditions of the river. The principal flooding is that due to the construction of the new dam at Crockers Rifts, which raises the water some two to three and a half feet below Fort Edward, but which affects the flooding very much more during the low stages than during high stages. Since the flooding of these lands occurs at the time of high water in the river, when the diluting effect is greatest, and since these lands are usually situated along tributaries in which the flow is toward the river, the flood land is very little, if any, subjected to deposition of suspended matter contained in the river water. This accounts for the little or no evidence of any deposits on flooded areas and no appearance of damage to the land or crops.

In regard to the production of odors and the creating of any nuisance as a result of them, it may be said that at the time of our examination no odors arising from the stream itself were noticeable at any points except immediately below the outlets from sulphite mills. As these wastes are discharged into the streams just below these outlets, before an opportunity is afforded for dilution and dispersion, the characteristic sulphite odors were always strong, but at a short distance below the outlets the odor quickly disappears. Since the odors from the sulphite mills are easily detected for a distance of miles from the mills, it is quite possible that these odors are frequently mistaken for odors of putrefaction arising from the stream. The organic matter comprising the pulp or woody fibre is mostly carbonaceous and not nitrogenous, and for this reason is not readily decomposable. This is clearly shown by the absence of putrefactive odors, the large amount of dissolved oxygen present (over 50 per cent. saturation) in the water below Fort Edward.

It should be said, however, that when a considerable area of the bed or banks of the streams upon which deposits of pulp have occurred are exposed to the sun and air, such as just below the mills at Fort Edward when the water power is shut off and the water is stored back of the dam, odors may, and probably do, arises from decomposition, and at such time create locally a nuisance. Again the volume of flow of the Hudson river, during some years, and at certain short periods of nearly every year, becomes much less than at the time of our examination, probably less than one-half as much, and at such times the dissolved oxygen in the river water may become so exhausted, and decomposition so active, that odors and local nuisances from the river water itself may result.

Since the petitioners allege that these wastes from these mills affect health and life, considerable efforts were made during this investigation to discover any reliable evidence to substantiate the allegation. No such evidence, however, was secured. A very few of the residents claimed that illnesses and even germ diseases were caused by these wastes, while a relatively large number claimed that the sulphite liquor and its characteristic odor were wholesome. In all of the alleged cases of illness or disease it is almost certain that the infection or inciting cause were either in no way connected with the river; or, if they were, it was due to the domestic sewage pollution and not to the pulp mill or industrial wastes.

(2) EFFECT OF POLLUTION BY DOMESTIC SEWAGE

When domestic sewage is discharged into a stream it may affect both health and comfort of persons residing along or in the vicinity of the stream below the points of discharge. It may affect health through the dangerous ingredients carried in the sewage, such as pathogenic bacteria, in case the water is used for any purpose by which these disease germs are conveyed into the system; and affect comfort by the creation of offensive odors resulting from the decomposition of the organic matter.

It was previously shown that at the time of the examination the pollution along the Hudson river and tributaries by domestic sewage was, with one or two exceptions, so inconsiderable that no nuisances were created. Extensive experience in this country and abroad has demonstrated that in general a nuisance will rarely be created in a stream if the volume of flow per 1,000 population contributing sewage is greater than seven cubic feet per second. Column 9 of table V of Appendix D gives the average summer flows per 1,000 population for the various points along the Hudson river and from this data it will be seen that at no point along the river does the flow approach this limit of seven cubic feet per second. In fact, at the point of maximum pollution at Waterford the volume of flow is some eight times that necessary to create a nuisance.

Although not shown by the tables and diagrams, but shown by the chemical analyses, the pollution of both Kayaderosseras creek and Hoosick river by domestic sewage is such that at times a nuisance might undoubtedly have been created. The drainage area and the volume of flow at the points of maximum pollution, *i. e.,* below Ballston Spa on Kayaderosseras creek and below North Adams on the Hoosick river are relatively small and this accounts for the occasional nuisances that must be occasioned at times on these streams. In fact, on Kayaderosseras creek it was shown that the dissolved oxygen just above the entrance to Saratoga lake was almost entirely exhausted, the point of exhaustion being, in general, the limit beyond which anaerobic decomposition sets in and odors arise.

It is usual in studying the effect which pollution of any stream has upon public health to use mortality statistics, especially typhoid mortality, as an index or criterion. This index has of course a greater value when the cities and villages use the stream as a source of water supply. The municipalities along the Upper

Hudson river and its main tributaries derive their water supplies almost exclusively from sources other than the Hudson river and its main tributaries and, as might be expected, the typhoid fever statistics throw but little light upon the question of public health in its relation to the pollution of the Upper Hudson river.

In order not to omit any possible evidence of this nature, however, the typhoid fever statistics for the three counties of Warren, Saratoga and Washington were collected from the statistics of this Department from 1890 to 1905 inclusive and summarized in tables Nos. VII and VIII, Appendix F. Table No. VII gives a list of the villages and towns in each county for which statistics were thus available, and table No. VIII the summary of mortalities from typhoid fever of these three counties arranged in three periods of five years each from 1891 to 1905 inclusive.

From table No. VIII it will be seen that the typhoid mortality for the two counties of Warren and Washington, in which the people reside in smaller villages, is in general somewhat less than in Saratoga where the people reside in larger municipalities and the population is more dense. Taking the five-year periods separately, the mortalities in Warren and Saratoga counties are higher in the period from 1895 to 1900 than in the two periods preceding and following this one, whereas in Washington county there is a progressive increase for the three successive periods. The average mortalities for all three periods, however, show an increase in the middle period from 1895 to 1900, while for the other two periods, ending in 1895 and 1905 respectively, the mortalities are very closely the same.

The evidence then, so far as is shown by typhoid fever statistics, indicates that with these municipalities using water supplies from other sources than the Hudson river the discharge of sewage and wastes into the Upper Hudson river has not affected the general public health of this region.

VI. MEANS FOR ELIMINATION OF POLLUTION

In the light of the present advanced state of our knowledge of the purification of domestic sewage and industrial wastes the problem of preventing or removing the existing pollution of the Hudson river offers no engineering difficulties of any grave importance. The question is one largely of cost and from this standpoint the responsibility must rest almost entirely with the municipalities and millowners.

The long list of municipalities in this country and abroad which are successfully disposing of their domestic sewage in a satisfactory manner leaves little room for doubt or discussion as to the efficacy and economy in the purification of the sewage of cities and villages in this State when sanitary conditions demand the removal of this class of sewage from any stream. With industrial wastes, however, purification is somewhat more complex but can be as successfully accomplished at a cost which, for a large majority of the industries is reasonable, and for the remaining ones not prohibitive.

In the case of sulphite pulp mills it should be said, in justice to their owners, that the disposal of sulphite liquor has up to this time presented the greatest difficulties in the way of successful and economical purification of any class of industrial wastes. In fact, no process has yet been discovered for the disposal of this waste at a low cost, although progress has been made along the lines of utilization, by which the net cost will be considerably reduced. Even should such methods not prove economical it is entirely possible to dispose of the liquor by dessication and incineration, at a cost that should not be prohibitive; or possibly by the ozone process which very recently has given promise of low cost in operation.

Aside from the more difficult problem of sulphite liquor disposal there is little question regarding the successful and economical disposal of the wastes in other processes of pulp and paper manufacture and of the wastes from woolen, knitting, wall-paper and cotton-print mills. In the wastes from nearly all of these mills the suspended matters constitute the principal ingredients to be disposed of, and these can without difficulty be largely, if not entirely, removed by adequate screening or filtration or by plain sedimentation and chemical precipitation. In some instances these methods may be aided or supplemented by biological processes such as the septic tank.

A noticeable feature that was evident in most of the mills was the apparent lack of efforts to use over again the maximum amount of " white water," in the grinding processes, or to recover any pulp beyond that which could produce a money-saving in the processes. For instance, " Decker machines," which are of small size and occupy a very limited floor space, were in use in many of the mills because these machines screen out an amount of pulp that pays for their installation and operation. If, however, similar and larger machines could be used, provided with screens of finer mesh, and the machines could be applied to all wastes from both pulp and paper processes that contain pulp fibre, a very considerable amount of pulp would be prevented from discharging into the stream.

VII. SUMMARY AND CONCLUSIONS

A brief summary will now be presented of the principal facts and results reached in this investigation, as above set forth, together with the conclusions based thereon, as follows:

(1) The Upper Hudson river and its tributaries are polluted by the industrial wastes from some 35 pulp and paper mills, 10 knitting mills, 8 woolen mills, 7 wall-paper mills, and 3 cotton-print mills in the States of New York, Massachusetts and Vermont; and by the domestic sewage of a population of some 79,000 residing also in these three states.

(2) The total pollution from industrial wastes amounts to about 1,460,000 pounds daily, of which about 98.7 per cent. is derived from pulp and paper mills, 0.1 per cent. from knitting mills, 0.7 per cent. from woolen mills, 0.1 per cent. from wall-paper mills, and 0.4 per cent. from cotton-print mills.

(3) Of this total amount of wastes, about 79 per cent. is of organic origin and about 21 per cent. mineral. Of the organic matter, about 13½ per cent. is pulp fibre from ground wood pulp and from the paper mills and about 61 per cent. is dissolved wood lignin from sulphite pulp mills; about 4 per cent. is woody refuse from the soda ash process and the remaining ½ of 1 per cent. is refuse from woolen mills, knitting mills and other industrial plants. Of the 21 per cent. mineral matter, about 17 per cent. is from chemicals used in pulp and paper mills and 4 per cent. from knitting, woolen and other mills.

(4) Of the total wastes approximately 96 per cent. are discharged into the Hudson river, about 1.5 per cent into the Batten Kill, about 1.5 per cent. into Kayaderosseras and Fish creeks and 1 per cent. into Hoosick river.

Conclusions

In view of the facts collected and described in the foregoing pages, I have the honor to report my conclusions as follows:

(1) I believe that above Corinth there is no appreciable pollution of the Hudson river.

(2) The pollution of the river begins at Corinth where a pulp mill discharges sulphite waste.

(3) From Glens Falls to Fort Edward there are ten mills which add very much to the pollution.

(4) Owing to the large amount of wastes discharged into the Hudson river above Fort Edward the pollution of the river below Fort Edward by industrial wastes is more intense than at any other point along its course and the effect upon public comfort the most serious and the interference with the full enjoyment of property most complete.

(5) The pollution of the Hudson river below Fort Edward from industrial wastes consists almost entirely of the chemicals and pulp fibre discharged into the river by the pulp and paper mills, the effect of which upon the river is to discolor the water, increase the turbidity, fill the stream to a more or less degree with fine suspended and coarse masses of pulp fibre and to produce a deposit of pulp fibre and chemicals upon the banks and bed of the river. These conditions of the river continue in a considerably diminishing degree, for a distance of many miles below Fort Edward, and in an appreciable degree as far down as the Mohawk river.

(6) The effect of this industrial pollution upon the comfort and convenience of residents at Fort Edward and below on the river is to render the water unfit for drinking or other domestic purposes; to render ice cut from the river unfit for drinking purposes; to detract from the pleasures of boating and bathing, and to poison and kill the fish.

(7) There is no indication that the crops raised upon any lands flooded at times by the river are injured in any way by the pollution of the stream.

(8) During this investigation no odors were detected arising from the water of the river except at the points immediately below sulphite pulp mills, although odors from the sulphite mills themselves were detected for a distance of two miles or more in the direct path of the wind.

(9) There is no reliable evidence that the wastes from these industries upon the Upper Hudson affect in an appreciable degree the security of life and health of persons residing in the municipalities or along the river.

(10) I believe, therefore, that the conditions found to exist in the Hudson river constitute a public nuisance, causing injury, inconvenience, annoyance and discomfort to riparian owners in the enjoyment of their legitimate and reasonable rights of property; that the present discharge of the industrial wastes described is unauthorized and unwarranted, offensive to the senses, and that its continuance is unreasonable; and that it injures and damages riparian owners to a material degree in their legitimate right to the enjoyment of comfort and property.

Respectfully,

EUGENE H. PORTER,
Commissioner of Health

This report was prepared by Mr. Theodore Horton, chief engineer of the Department of Health, assisted by:

Prof. H. N. Ogden, assistant sanitary engineer;
Mr. H. B. Cleveland, assistant sanitary engineer;
Dr. H. D. Pease, director, and L. M. Wachter, chief sanitary chemist, of the State Hygienic Laboratory,
and a number of assistants in laboratory work, inspectors, etc.

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APPENDIX A

TABLE NO. I

MEAN MONTHLY FLOW OF THE HUDSON RIVER AT MECHANICVILLE DAM FOR THE YEARS 1890–1906, INCLUSIVE

Cubic feet per second

MONTH.	YEAR.																	
	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	Average.
January	11,270	8,284	18,857	3,192	6,757	3,876	6,787	4,007	7,723	6,668	5,841	3,087	......	7,034	5,805	6,097	9,305	6,740
February	7,913	11,664	9,263	4,805	4,836	3,543	4,668	3,895	6,754	5,258	12,484	2,888	4,741	9,885	6,858	3,544	7,650	6,500
March	11,129	17,736	10,929	8,250	14,738	4,204	13,600	12,214	20,220	9,618	7,740	8,095	25,130	30,938	11,055	9,388	8,906	13,170
April	15,053	20,021	21,554	17,889	11,135	23,822	24,972	19,080	13,712	23,645	22,614	28,268	15,222	14,013	20,737	22,748	20,596	19,720
May	17,931	5,533	19,622	22,285	7,566	6,850	4,610	12,151	11,095	9,752	8,992	11,658	7,949	3,509	13,323	8,171	13,269	11,420
June	7,392	3,200	12,395	4,801	7,097	2,816	4,738	11,861	5,280	2,598	4,093	7,806	6,315	8,472	6,765	9,418	9,290	6,730
July	1,950	2,337	9,287	2,521	3,168	2,559	2,772	10,722	2,570	2,273	2,352	3,551	8,934	4,863	2,622	6,870	5,780	4,440
August	2,019	2,666	5,485	5,005	2,456	3,901	2,442	8,240	5,101	1,393	2,703	4,661	6,286	5,905	6,259	5,631	3,482	4,330
September	8,844	2,040	4,448	6,870	1,889	2,629	2,879	2,756	3,872	2,074	1,886	4,024	3,643	4,118	6,660	12,032	3,072	4,330
October	9,215	1,472	2,819	3,865	3,649	2,631	4,106	2,524	7,895	2,617	2,128	4,264	6,894	10,117	11,780	6,067	3,370	4,730
November	9,121	4,068	7,604	3,639	6,379	8,421	11,352	9,962	9,243	6,382	5,077	3,732	7,076	5,769	4,644	*	5,127	5,410
December	3,244	8,577	4,031	7,217	4,367	10,889	6,913	13,741	5,436	7,303	5,331	8,491	9,162	5,297	3,922	*	4,877	6,380

* Records not given for November and December.

APPENDIX A

TABLE NO. II

MEAN DAILY FLOW OF THE HUDSON RIVER AT MECHANICVILLE DAM, FROM JUNE 12–30, INCLUSIVE, 1907

Cubic feet per second

Date.	Flow.	Date.	Flow.	Date.	Flow.	Date.	Flow.
June 12........	5,739	June 17..	5,389	June 22..	4,952	June 27..	5,568
June 13........	5,263	June 18..	4,935	June 23..	3,894	June 28..	3,636
June 14........	4,913	June 19..	4,831	June 24..	4,643	June 29..	4,763
June 15........	5,236	June 20..	3,587	June 25..	3,925	June 30..	3,713
June 16........	3,709	June 21..	3,315	June 26..	4,051		
						Average..	4,544

APPENDIX C

TABLE NO. III

SHOWING AMOUNTS OF DIFFERENT KINDS OF INDUSTRIAL WASTES DISCHARGED INTO THE UPPER HUDSON RIVER AND TRIBUTARIES BY MILLS AND INDUSTRIAL ESTABLISHMENTS

NAME OF MILL OR FACTORY.	Location.	Stream on which mill is situated.	Number of employees.	Product, amount daily.	Amount of Waste, in Pounds, Daily.								Total organic wastes.	Total mineral wastes.	Total wastes.
					Lime.	Sulphur.	Woody refuse.	Clay.	Soap.	Wool, grease and fibre.	Dyes.	Miscellaneous salts and drugs.			
Schroon River Pulp & Paper Co.	Near Warrensburg	Schroon river	75	Gr. wood pulp, 20 tons Paper, 22 tons	....	......	4,000 2,000	1,100	....	....	....	....	....	......	....
Warrensburg Woolen Co.	Warrensburg	Schroon river	45	Woolen cloth, 16 pieces	....	......	......	......	160	200	1.0	100	6,560	1,200	7,760
Union Bag & Paper Co.	Hadley	Hudson river	88	Gr. wood pulp, 9 tons Paper (bag), 26 tons	....	......	1,800 2,600	1,300	....	....	....	....	10,960	2,500	13,460
International Paper Co.	Corinth	Hudson river	700	Sulphite pulp, 70 tons Gr. wood pulp, 150 tons Paper, 160 tons	12,250	17,500	175,000 30,000 16,000	8,000	....	....	....	....	231,960	40,250	272,210
Finch, Pruyn & Co.	Glens Falls	Hudson river	127	Gr. wood pulp, 50 tons Paper, 50 tons	....	......	10,000 15,000	2,500	....	....	....	....	....	......	....
perial Wall Paper Co.	Glens Falls	Hudson river	225	Wall paper, 25 tons	....	......	......	2	....	....	1.0	1	....	......	....
International Paper Co.	S. Glens Falls	Hudson river	350	Gr. wood pulp, 66 tons Paper, 160 tons	....	......	13,200 16,000	8,000	....	....	....	....	....	......	....
Union Bag & Paper Co., No. 5 Mill	Sandy Hill	Hudson river	75	Gr. wood pulp, 5 tons Paper, 19 tons	....	......	1,000 1,900	950	....	....	....	....	....	......	....
Union Bag & Paper Co., No. 2 Mill	Opp. Sandy Hill	Hudson river	60	Gr. wood pulp, 20 tons	....	......	4,000	......	....	....	....	....	....	......	....
Union Bag & Paper Co., Fenimore Mill	Opp. Sandy Hill	Hudson river	250	Sulphite pulp, 120 tons Paper, 30 tons	21,000	30,000	300,000 3,000	1,500	....	....	....	....	....	......	....
Union Bag & Paper Co., Baker's															

International Paper Co.	Fort Edward	Hudson river	550	Sulphite pulp, 30 tons Gr. wood pulp, 50 tons Paper, 155 tons	14,000	20,000	200,000 10,000 15,500	7,750					825,360	150,470	975,830
Fort Miller Pulp & Paper Co., paper mill	Fort Miller	Hudson river	23	Paper, 11 tons			1,100	550							
Fort Miller Pulp & Paper Co., pulp mill	Fort Miller	Hudson river	23	Gr. wood pulp, 8 tons			1,600								
Iroquois Pulp & Paper Co.	Thompson	Hudson river	42	Paper, 23 tons			2,300	1,150							
Union Box Board & Paper Co.	Thompson	Hudson river	120	Gr. wood pulp, 18.5 tons Paper, 20 tons			3,700 2,000	1,000							
Standard Wall Paper Co.	Northumberland	Hudson river	140	Wall paper, 17.5 tons				3			1.0	1	836,060	153,170	989,230
Phoenix Mill	Battenville	Batten kill	16	Paper, 4 tons			400	200							
Blandy Paper Co.	Center Falls	Batten kill	20	Paper, 7 tons			700	350							
Continental Bag Co.	Greenwich	Batten kill	14	Paper, 1.5 tons			150	75							
Dunbarton Flax Spinning Co.	Greenwich	Batten kill	140	Twine and thread, 1.2 tons							0.4	15			
Stevens & Thompson Paper Co.	Middle Falls	Batten kill	91	Gr. wood pulp, 9 tons Paper, 10 tons			1,800 1,000	500							
Bossom Mfg. Co.	Middle Falls	Batten kill	45	Leather board, 12 tons								200			
Mohegan Pulp & Paper Co.	Middle Falls	Batten kill	20	Gr. wood pulp, 14 tons			2,800						855,910	155,510	1,011,420
American Wood Board Co.	Clark's Mills	Batten kill	75	Gr. wood pulp, 55 tons Paper, 20 tons			11,000 2,000	1,000							
E. M. Brown Paper Co., Excelsior Mill	Rock City Falls	Kayaderosseras creek	20	Paper, 6 tons			600	300							
E. M. Brown Paper Co., Empire Mill	Rock City Falls	Kayaderosseras creek	20	Box board, 7 tons			700	350							
Pioneer Paper Co.	West Milton	Kayaderosseras creek	16	Paper, 7 tons			700	350							
National Folding Box Paper Co.	West Milton	Kayaderosseras creek	30	Paper, 11 tons			1,100	550							
Union Bag & Paper Co.	Ballston Spa	Kayaderosseras and Gordon creeks	340	Sulphite pulp, 38 tons Paper, 34 tons	6,650	9,500	95,000 3,400	1,700							
Schuylerville Paper Co.	Schuylerville	Fish creek	37	Paper (bag), 7 tons			700	350					958,110	175,260	1,133,370
William Pemble Paper Co.	Stillwater	Hudson river	20	Box board, 7 tons			700	350							
Upton Mill	Stillwater	Hudson river	15	Box board, 5 tons			500	250					959,310	175,860	1,135,170
Adams Woolen Mill	Adams, Mass.	Hoosic river	120	Woolen cloth, 18 pieces											
Renfrew Mfg. Co.	Adams, Mass.	Hoosic river	1,000	Cotton print, 175 pieces											
Berkshire Hills Paper Co.	Adams, Mass.	Hoosic river	125	Paper, 4 tons											
S. S. Brown Paper Co.	Adams, Mass.	Hoosic river	350	Paper, 6 tons											
Strong, Hewat & Co.	Clarksburg	Hoosic river	200	Woolen cloth, 20 pieces											
Waterhouse & Howard	N. Adams, Mass.	Hoosic river	235	Woolen cloth, 30 pieces											
North Adams Mfg. Co.	Braytonville, Mass.	Hoosic river	250	Woolen cloth, 27 pieces											
Blackinton Mfg. Co.	Blackinton, Mass.	Hoosic river	350	Woolen cloth, 30 pieces											
Arnold Print Co.	N. Adams, Mass.	Hoosic river	1,550	Cotton prints, 4,580 pieces											

TABLE NO. III — (*Concluded*)

NAME OF MILL OR FACTORY.	Location.	Stream on which mill is situated.	Number of employees.	Product, amount daily.	AMOUNT OF WASTE, IN POUNDS, DAILY.										
					Lime.	Sulphur.	Woody refuse.	Clay.	Soap.	Wool, grease and fibre.	Dyes.	Miscellaneous salts and drugs.	Total organic wastes.	Total mineral wastes.	Total wastes.
Windsor Mfg. Co.	N. Adams, Mass.	Hoosic river	650	Cotton prints, 3,300 pieces											
Holden, Leonard & Co.	Bennington, Vt.	Walloomsac river	275	Woolen cloth, 30 pieces											
Vermont Hosiery Co.	Bennington, Vt.	Walloomsac river	74	Hosiery, 250 dozen											
Tiffany Bros	Bennington, Vt.	Walloomsac river	50	Knit goods, 50 dozen											
Rockwood Mills	Bennington, Vt.	Walloomsac river	100	Knit goods, 70 dozen											
H. E. Bradford & Co.	Bennington, Vt.	Walloomsac river	300	Knit goods, 230 dozen											
Cooper Mfg. Co.	Bennington, Vt.	Walloomsac river	400	Knit goods, 400 dozen											
Stark Paper Co.	N. Bennington and Sodom, Vt.	Walloomsac river	40	Wall paper, 4.5 tons											
Walloomsac Paper Co.	Walloomsac	Walloomsac river	65	Wall paper, 14 tons			1,050	525							
Stevens & Thompson Mill	North Hoosic	Walloomsac river	65	Wall paper, 2.8 tons											
Sprague & Co.	Johnsonville	Hoosic river	20	Leather board, 2 tons								40			
Valley Falls Flax Mills	Valley Falls	Hoosic river	150	Twines and cotton cloth, 9 tons							1.0	30			
Schaghticoke Mills Co.	Schaghticoke	Hoosic river	250	Woolen cloth, 15 pieces					150		3.4	100			
Cable Flax Mills	Schaghticoke	Hoosic river	125	Twines, 1.5 tons									972,020	178,250	1,150,270
West Virginia Pulp & Paper Co.	Mechanicville	Hudson river	600	Sulphite pulp, 45 tons	7,875	11,250	112,500								
				Soda pulp, 60 tons	102,000		60,000								
				Paper, 100 tons			10,000	5,000							
Mechanicville Knitting Co.	Mechanicville	Hudson river	100						100						
Ford Mfg. Co.	Waterford	Hudson river	225	Knit goods, 330 dozen					200	130		130			
Harmony Knitting Mills	Waterford	Hudson river	150	Knit goods, 250 dozen					150	100		150	1,155,200	304,655	1,459,855

APPENDIX D

TABLE NO. IV

LIST OF CITIES AND VILLAGES THAT DISCHARGE DOMESTIC SEWAGE INTO THE UPPER HUDSON RIVER AND ITS TRIBUTARIES WITH ESTIMATED TOTAL POPULATIONS AND POPULATIONS CONTRIBUTING SEWAGE

CITY OR VILLAGE.	Population.	Description of sewers.	Estimated population contributing sewage.	Stream receiving sewage.
Warrensburg	1,200	Private	140	Schroon.
Corinth*	2,200	System	1,300	Hudson.
Glens Falls	16,000	System	15,000	Hudson.
South Glens Falls	2,100	Private	15	Hudson.
Sandy Hill	6,000	System	5,000	Hudson.
Fort Edward	4,000	Partial	2,500	Hudson.
Manchester, Vt	500	Partial	300	Batten kill.
Shushan	500	Partial	75	Batten kill.
Salem	1,300	Partial	200	White Creek.
Greenwich	2,000	Partial	400	Batten kill.
Ballston Spa†	4,200	System	3,900	Kayaderosseras.
Saratoga Springs*	13,000	System	12,000	Fish creek.
Victory Mills	750	Private	200	Fish creek.
Adams, Mass.‡	11,000	Private	4,500	Hoosic.
North Adams, Mass.‡	24,200	System	23,000	Hoosic.
Williamstown, Mass.‡	5,000	Partial	2,000	Hoosic.
Hoosic Falls, N. Y.	5,500	System	4,200	Hoosic.
Bennington, Vt	6,000	System	6,000	Walloomsac.
Johnsonville	550	Private	50	Hoosic.
Valley Falls	900	Private	50	Hoosic.
Schaghticoke	1,200	Private	12	Hoosic.
Round Lake*	300	System	250	Anthony kill.
Mechanicville	6,000	System	4,000	Hudson.
Waterford	3,150	System	1,900	Hudson.

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* At Corinth, Saratoga Springs and Round Lake sewage disposal plants are in operation and, therefore, the population contributing sewage in those villages is not included in the total population contributing sewage to the river, appearing in column 5 of Table 5, Appendix D.

† At Ballston Spa a sewage disposal plant is completed and ready for operation but was not in operation at the time of this investigation.

‡ Information taken from Massachusetts State Board of Health report for 1902.

TABLE NO. V

STATISTICS SHOWING POLLUTION OF UPPER HUDSON BY DOMESTIC SEWAGE

	Distance from source.	Drainage area.	Total population on drainage area.	Population contributing sewage directly to river and tributaries.	Per cent. of population connected with sewers to total population.	Population per square mile on drainage. area.	Average summer flow of Hudson river.	Flow per 1,000 population contributing sewage.	Population per square mile sewering into streams.
	Miles.	*Sq. miles*					*Cu. ft. per sec.*	*Cu. ft. per sec.*	
Above mouth of Schroon river..........	72	900	5,100	350	6.9	5.6	873	2,500	0.4
Below mouth of Schroon river..........	72	1,457	13,800	790	5.7	9.4	1,430	1,810	0.5
Above mouth of Sacandaga river........	84	1,598	16,500	920	5.6	10.	1,550	1,690	0.6
Below mouth of Sacandaga river........	84	2,626	47,900	2,490	5.2	18.2	2,550	1,020	0.9
Above Corinth..........................	89.5	2,650	48,100	2,500	5.2	18.2	2,570	1,030	0.9
Below Corinth..........................	89.5	2,650	50,300	2,520	5	19.	2,570	1,020	0.9
Above Glens Falls (feeder dam).........	104.5	2,716	50,600	2,530	5	18.6	2,630	1,040	0.9
Below Fort Edward (railroad bridge)...	110	2,740	78,700	25,150	32.	28.7	2,660	106	9.2
Above mouth of Batten kill.............	121	2,910	84,550	25,270	30.	29.	2,320	112	8.6
Below mouth of Batten kill.............	121	3,360	100,250	26,550	26.5	29.8	3,260	122	7.9
Above mouth of Fish creek..............	122	3,370	101,900	26,600	26.	30.2	3,270	122	7.9
Below mouth of Fish creek..............	122	3,620	128,600	31,100	24.3	35.5	3,520	112	8.6
Above mouth of Hoosic river............	136	3,700	132,550	31,200	23.5	35.1	3,590	115	8.4
Below mouth of Hoosic river............	136	4,430	201,100	73,200	36.5	45.4	4,300	59	16.6
At Mechanicville (above dam)...........	138	4,500	201,200	73,200	34.5	44.7	4,360	60	16.3
Above mouth of Mohawk river............	148	4,620	223,100	79,100	38.3	44.9	4,480	56	17.2
Below mouth of Mohawk river............	148	8,210	....	....	....	....	....	....	....
Above Albany...........................	156	8 380	....	....	....	....	....	....	....

TABLE NO. VI

CHEMICAL AND BACTERIOLOGICAL ANALYSES OF HUDSON RIVER AND TRIBUTARIES AT SELECTED SAMPLING STATIONS SHOWN ON DRAINAGE AREA MAP

Number of sampling station.	River or stream.	Location of sampling station.	Date of collection of sample.	Determinations are in Parts per 1,000,000.									
				Color.	Free ammonia.	Albuminoid ammonia.	Nitrates.	Oxygen consumed.		Dissolved oxygen.	Temperature.	Chlorine.	Bacteria per cubic centimeter.
								30 min.	5 min.		C.		
I	Hudson	Near Thurman, 1,000 feet above mouth of Schroon	June 21, 1907	40	.020	.102	0.00	7.65	6.40	8.35	23.0	0.48	310
II	Sacandaga	Near Hadley, 600 feet above mouth	June 21, 1907	15	.008	.074	0.00	4.90	3.75	8.27	22.1	0.72	500
III	Hudson	Near Corinth, one-quarter mile below pulp mill	June 21, 1907	15	.022	.086	0.00	8.10	6.75	8.00	22.0	0.96	360
IV	Hudson	Above Glens Falls, opposite S. Glens Falls pumping station	June 21, 1907	26	.006	.088	0.00	12.4	10.70	6.75	23.2	0.96	......
V	Hudson	Fort Edward, right channel, 300 feet above lower end of Freeman's Island	June 22, 1907	27	.018	.104	0.00	27.00	23.40	6.70	23.3	1.20	130
VI	Hudson	Fort Edward, left channel, 200 feet above lower end of Freeman's Island	June 22, 1907	28	.024	.124	0.00	33.80	34.20	4.60	25.0	1.53	210
VII	Hudson	Near Fort Edward, main channel, three-quarters of mile below Freeman's Island	June 22, 1907	18	.016	.100	0.00	23.60	21.20	6.88	23.3	1.72	240
VIII	Hudson	Near Fort Miller, 1,000 feet above Crocker's Rift dam	June 22, 1907	32	.022	.112	0.00	30.80	30.00	5.15	24.5	1.44	1,350
IX	Batten kill	Near Battenville, 1½ miles above village	June 29, 1907	0	.024	.070	0.24	3.60	3.20	8.63	21.1	0.96	400
X	Batten kill	Clark's Mills, below dam and tail race from mill	June 29, 1907	0	.004	.100	0.16	3.80	4.60	7.38	22.0	1.44	1,000
XI	Hudson	Schuylerville, right channel at highway bridge above Fish creek	June 22, 1907	27	.014	.124	0.00	26.00	22.80	5.95	24.5	1.72	650
XII	Kayaderosseras	Near Rock City Falls, at highway bridge 1 mile above village	July 10, 1907	.....	.010	.058	0.28	2.65	2.10	8.77	21.6	0.84	230
XIII	Kayaderosseras	Near Ballston Spa, one-half mile below sewage disposal plant	June 28, 1907	0	.038	.600	0.30	164.50	150.00	1.50	26.3	12.68	160,000

TABLE NO. VI — (*Continued*).

Number of sampling station.	River or stream.	Location of sampling station.	Date of collection of sample.	DETERMINATIONS ARE IN PARTS PER 1,000,000.									
				Color.	Free ammonia.	Albuminoid ammonia.	Nitrates.	OXYGEN CONSUMED.		Dissolved oxygen.	Temperature.	Chlorine.	Bacteria per cubic centimeter.
								30 min.	5 min.		C.		
XIV	Kayaderosseras	One-half mile above Saratoga lake and above mouth of outlet of Lonely lake.	June 28, 1907	0	.085	.400	0.08	70.00	59.00	0.30	20.8	13.88	6,200
XV	Fish creek	Stafford's bridge, 2 miles below Saratoga lake	June 28, 1907	0	.040	.172	0.00	22.00	22.00	6.50	25.5	5.74	400
XVI	Fish creek	Near Victory Mills, 1 mile above village	June 29, 1907	0	.052	.182	0.00	20.80	15.80	6.13	23.5	5.74	1,800
XVII	Hudson	Schuylerville, three-quarters of mile below highway bridge and below Fish creek	June 24, 1907	28	.008	.108	0.00	23.80	22.20	5.54	25.3	1.44	....
XVIII	Hudson	Stillwater, 1,000 feet above highway bridge	June 25, 1907	0	.010	.140	0.00	27.00	27.00	3.16	25.2	1.91	1,500
XIX	Hoosic	Near N. Pownal, Vt., 1 mile below village and 500 feet above State line	July 1, 1907	0	.030	.194	0.00	11.40	5.00	8.20	22.0	2.39	1,150
XX	Hoosic	Near Stillwater, one-half mile above mouth	July 1, 1907	0	.210	.168	0.00	11.00	4.20	7.80	18.8	2.51	3,700
XXI	Hudson	Mechanicville, 1 mile below highway bridge	June 25, 1907	27	.006	.166	0.00	22.60	21.60	4.85	25.2	1.91	1,700
XXII	Hudson	Waterford, 1,500 feet above Waterford bridge	June 26, 1907	0	.010	.136	0.00	26.40	24.80	5.55	25.2	2.20	1,300
XXIII	Mohawk	Near Cohoes, 1,000 feet above Cohoes Company dam	June 26, 1907	0	.066	.156	0.06	9.60	10.20	5.61	26.0	4.31	640
XXIV	Hudson	Troy, below Mohawk, 1,200 feet above State dam	June 25, 1907	28	.008	.174	0.00	14.40	14.60	6.26	27.3	2.97	5,200
XXV	Hudson	Albany, 2 miles above city, opposite Lagoon Island	June 27, 1907	0	.018	.210	0.00	22.00	19.80	3.80	25.0	8.52	8,300

APPENDIX F

TABLE NO. VII

List of Towns and Villages in the Counties of Warren, Washington and Saratoga Situated upon the Upper Hudson Drainage Basin, Included in Table No. VIII

Warren County

Bolton
Caldwell
Chester
Hague
Horicon
Johnsburg
Luzerne
Queensbury
Glens Falls (village)
Stony Creek
Thurman
Warrensburg

Washington County

Argyle
Cambridge
Easton
Fort Edward
Sandy Hill (village)
Greenwich
Hebron
Jackson
Kingsbury
Salem
White Creek

Saratoga County

Ballston Spa (village)
Ballston
Charlton
Clifton Park
Corinth
Day
Edinburg
Galway
Greenfield
Hadley
Halfmoon
Malta
Mechanicville (village)
Milton
Moreau
Northumberland
Providence
Saratoga
Saratoga Springs (village)
Stillwater
Saratoga Springs
Waterford
Wilton

TABLE NO. VIII

TYPHOID FEVER MORTALITIES IN THE PORTIONS OF THE COUNTIES OF WARREN, WASHINGTON AND SARATOGA SITUATED WITHIN THE DRAINAGE BASIN OF THE UPPER HUDSON RIVER, FROM 1891 TO 1905, INCLUSIVE, GROUPED ACCORDING TO FIVE YEAR PERIODS

COUNTY.	1891.	1892.	1893.	1894.	1895.	Average.	Average population.	Death rate per 100,000.	1896.	1897.	1898.	1899.	1900.	Average.	Average population.	Death rate per 100,000.	1901.	1902	1903.	1904.	1905.	Avearge.	Average population.	Death rate per 100,000.
Warren........	5	6	10	11	2	6.8	28,700	23.7	8	10	6	9	10	8.6	29,300	29.5	9	7	8	8	6	7.6	30,800	24.6
Washington....	6	7	12	6	3	6.8	30,000	22.7	7	8	7	11	9	8.4	29,900	28.1	8	8	6	5	17	8.8	30,200	29.2
Saratoga.......	18	18	12	21	22	18.2	57,600	31.6	26	19	22	23	18	21.6	60,100	35.9	25	9	16	15	22	17.4	62,000	27.2
						31.8	116,300	27.4						38.6	119,300	32.4						33.8	123,000	27.5

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March 29, 1907.

To His Excellency, HON. CHARLES E. HUGHES, *Governor of the State of New York, Albany, N. Y.:*

The petition of the undersigned, residents, taxpayers and riparian owners of Washington, Warren and Saratoga counties of the State of New York, respectively, shows as follows:

1. That the Hudson river flowing between or bounding the counties of Washington, Warren and Saratoga, from the time of its discovery up to comparatively recent years, was noted for the purity and potability of its waters.

2. That fishing, boating and bathing; the unusual attractions of its natural resources, together with its early associations in the events of our national history, has made it a point of interest to thousands of tourists and the progressive student.

3. That rising in the midst of a great variety of scenic beauty; flowing through a greater portion of the world renowned Adirondack mountains, it reaches New York bay through the Catskill range and the famous Highlands. Wherefore a large population now exists and the inference is that region will continue to become the abode of many men in quest of recreation and health; likewise the development of our industries through legitimate and lawful methods.

4. That the waters of the said Hudson river are now alleged to be polluted by certain sludge acids and certain other refuse and wastes discharged by certain pulp mills and other industrial establishments.

5. That your petitioners beg to submit that the said pulp mills, factories and other industrial establishments are now violating the Laws of New York, chapter 468, section 1, paragraph 75, etc., and to state that the discharge from said pulp mills, factories and other industrial establishments, discolors the water; kills the fish; gives rise to unhealthy and offensive odors; pollutes and poisons the water rendering it unfit for agricultural and domestic purposes, constituting a continuing nuisance.

6. That the owners of the said pulp mills and industrial establishments admit the pollution of the said river, and admit that they have made no provision for the disposal of such sludge

acids, refuse and wastes which they continue to discharge into the said river.

Your petitioners, therefore, pray that Your Excellency will exercise the power in you vested by law to examine into the matter aforesaid with a view of abating the nuisance aforesaid.

And your petitioners will ever pray.
Fred Linendoll, Moses Kill, N. Y.
Ed. Newton, Moses Kill, N. Y.
Fred Bristol, Fort Edward, N. Y., R. F. D.
W. A. Sanders, Fort Edward, N. Y.
Albert Green, Moses Kill, N. Y.
Wm. E. Grey, Gansevoort, N. Y., R. F. D.
J. W. Taylor, Fort Edward, N. Y.
Benj. Smith, Fort Edward, N. Y.
Charles H. Marshall, Fort Edward, N. Y.
Robert Blackburn, Fort Edward, N. Y.
George Godfrey, Fort Edward, N. Y.
Wilson Wells, Gansevoort, N. Y., R. F. D.
D. A. Vaughn, Gansevoort, N. Y., R. F. D.
Albert McMorray, Gansevoort, N. Y., R. F. D.
Bert T. Smith, Gansevoort, N. Y., R. F. D.
Geo. W. Smith, Gansevoort, N. Y., R. F. D.
Geo. P. Cook, Gansevoort, N. Y., R. F. D.
Helen M. Webster, Gansevoort, N. Y., R. F. D.
Ella B. Stewart, Gansevoort, N. Y., R. F. D.
Geo. H. Norton, Gansevoort, N. Y., R. F. D.
R. A. Henderson, Gansevoort, N. Y., R. F. D.
Byron Hunt, Gansevoort, N. Y., R. F. D.
P. D. Hunt, Gansevoort, N. Y., R. F. D.
J. S. Vaughn, Fort Edward, N. Y.
F. B. Vaughn, Fort Edward, N. Y.
C. E. Goodfellow, Fort Edward, N. Y.
E. H. Moon, Fort Edward, N. Y.
R. B. Vaughn, Fort Edward, N. Y.
Geo. W. Brayton, Glens Falls, N. Y.
C. A. Ashley, Fort Edward, N. Y.
B. M. Tasker, Fort Edward, N. Y.
Nathaniel Carswell, Fort Edward, N. Y., R. F. D.

C. G. Henderson, Fort Edward, N. Y.
Samuel Turner, Fort Edward, N. Y.
Mrs. Andrew Smith, Fort Edward, N. Y.
Benjamin Metcalf, Fort Edward, N. Y.
Henry Metcalf, Fort Edward, N. Y.
William Turner, Fort Edward, N. Y.
Mrs. Gertrude Harris, Fort Edward, N. Y.
D. C. Linendoll, Fort Edward, N. Y.
Harmon Linendoll, Fort Edward, N. Y.
Mrs. Irving Bristol, Fort Edward, N. Y.
Robt. Ellis, Fort Edward, N. Y.
L. Sadler, Fort Edward, N. Y.
Edward I. Shannahan, Moses Kill, N. Y.
Lewis Ketchum, Moses Kill, N. Y.
W. Vaughn, Fort Edward, N. Y., R. F. D.
Levi A. Cady, Fort Edward, N. Y., R. F. D.
John B. Lauder, Fort Edward, N. Y.
Henry K. Grot, Fort Edward, N. Y.
John Griffin, Fort Edward, N. Y.
Thomas B. Sanders, Moses Kill, N. Y.
Mrs. Mary H. Sanders, Moses Kill, N. Y.
Frank Morrissey, Moses Kill, N. Y.
W. H. Sanders, Moses Kill, N. Y.
Irving Dickinson, Moses Kill, N. Y.
W. W. Patterson, Moses Kill, N. Y.
W. Irving Bristol, Fort Edward, N. Y., R. F. D.

To the State Commissioner of Health:

Having been presented with a petition signed by residents of the counties of Washington, Warren and Saratoga, stating that the waters of the Hudson river, as it flows between, along and through said counties, are being polluted by the discharge therein of sludge acids and other refuse and wastes from pulp mills and other industrial establishments in violation of law, and that such waters are thereby rendered unhealthy and offensive and unfit for agricultural and domestic purposes, and that such pollution constitutes a nuisance;

I therefore require you, in accordance with the provisions of section 6 of article 1 of the Public Health Law, to make an examination into the alleged nuisance and questions affecting the security of life and health in the locality aforesaid, and to report the results thereof to me on or before the 15th day of August, 1907.

[EXECUTIVE PRIVY SEAL.] Dated at the Capitol at Albany this 17th day of May, 1907

(Signed) CHARLES E. HUGHES

By the Governor:

ROBERT H. FULLER,
Secretary to the Governor

NOTICE OF PUBLIC HEARING

Notice is hereby given that a public hearing will be held at the trustees' rooms in the village of Fort Edward, N. Y., on July 2, 1907, at 1 o'clock in the afternoon, to hear evidence on the alleged pollution of the Hudson river by certain sludge acids and other refuse and wastes discharged by certain pulp mills and industrial establishments, into the waters of said river and its tributaries. The petition of certain residents, taxpayers and riparian owners in Washington, Warren and Saratoga counties in the State of New York, dated March 29, 1907, and directed to His Excellency, Hon. Charles E. Hughes, Governor of the State of New York, alleges that said pulp mills, factories and other industrial establishments are violating the laws of New York, and that the discharge from the same discolors the water, kills the fish, gives rise to unhealthy and offensive odors, pollutes and poisons the water rendering it unfit for agricultural and domestic purposes, and constitutes a continuing nuisance.

And an Executive order, based on said petition, and dated May 17, 1907, having been made, directed to the State Commissioner of Health, requiring him in accordance with the provisions of section 6 of article 1 of the Public Health Law to make an examination into the alleged nuisance and questions affecting the security of life and health, and to report the results thereof to the Governor, all said petitioners, complainants, riparian owners; and owners, proprietors or managers of said pulp mills, factories and other industrial establishments, above referred to and any and all other persons interested herein, are hereby notified and required to appear before me at said time and place for the purpose of giving testimony regarding said complaint.

Dated, Albany, N. Y., June 20, 1907.

EUGENE H. PORTER,
State Commissioner of Health

A copy of the above notice was served upon each person who signed the petition to the Governor, and upon the proprietors of all the pulp and paper mills and was also published in newspapers in Keeseville, Glens Falls and Fort Edward. A hearing was held at Fort Edward on July 2, 1907 and the testimony of witnesses was taken. A copy of the evidence was transmitted to the Governor with the foregoing report.

CANTON

POLLUTION OF DE GRASSE (OR GRASSE) RIVER

To the State Commissioner of Health:

Complaint having been made by residents of the village of Canton in the county of St. Lawrence that the waters of the De Grasse (or Grasse) river are being polluted and contaminated because of the discharge therein by the De Grasse Paper & Pulp Company of waste and refuse matter from the manufacturing conducted by said company and because of the discharge therein of other deleterious refuse and waste matter and that thereby such waters are rendered unhealthy and offensive and unfit for agricultural or domestic purposes and are rendered unfit to be drunk by man or beast; and it being charged that such pollution and contamination constitutes a nuisance:

I therefore require you, in accordance with the provisions of section 6 of article 1 of the Public Health Law, to make an examination into the alleged nuisance and all questions affecting the security of life and health in the locality aforesaid, and to report the results thereof to me on or before the 9th day of December, 1907.

[SEAL] Given under my hand and the privy seal of the State at the Capitol in the city of Albany this thirtieth day of November in the year of our Lord one thousand nine hundred and seven.

(Signed) CHARLES E. HUGHES

By the Governor:
ROBERT H. FULLER,
Secretary to the Governor

ALBANY, N. Y., *December* 6, 1907.

Hon. CHARLES E. HUGHES, *Governor of the State of New York, Albany, N. Y.:*

SIR:— I have the honor to submit herewith my report upon an investigation of the pollution of the De Grasse* (or Grasse) river above the village of Canton in the county of St. Lawrence, with special reference to the alleged nuisance and detriment to health caused by the discharge of wastes from the mills of the De Grasse Paper Company.

The investigation was undertaken in pursuance of an Executive order dated November 30, 1907, requiring the State Commissioner of Health, in accordance with the provisions of section 6 of article 1 of the Public Health Law, to make an investigation into the alleged nuisance and all questions affecting the security of life and health in the locality aforesaid, and to report the results thereof on or before the 9th day of December, 1907.

A careful inspection was made of the character and extent of the pollution caused by the wastes of the De Grasse Paper Company's mills and of the effect thereof upon the quality of the water of the river in creating a nuisance or in menacing the purity of the water supply of the village of Canton. This inspection was further supplemented by chemical and bacteriological examinations of the quality of the water of the river at points above and below the De Grasse Paper Company's mills. A general description of the conditions surrounding the village of Canton and the De Grasse Paper Company's mills, together with the results of the observations and examination, are presented as follows:

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* The name of this river is variously referred to as follows: Lippincott's Gazetteer, *Grass* (or *De Grasse*); Hough's Gazetteer, *Grass*; U. S. Topographical and N. Y. State Geologic maps, *Grasse*: Longman's Gazetteer, *Grass*; Curtis' History of St. Lawrence County, *Grass*; Scarborough's map, *La Grasse*.

The De Grasse (or Grasse) river rises in the south-central portion of St. Lawrence county and flows northerly to the St. Lawrence river at a point near the northeasterly corner of St. Lawrence county. The drainage area of the De Grasse (or Grasse) river at the hamlet of Pyrites is about 342 square miles and at the village of Canton is about 515 square miles. The average summer flow just above Canton may be taken at about 500 cubic feet per second and the minimum summer flow about 250 cubic feet per second. The population on the drainage area above Canton is about 8,500.

The village of Canton is located on the right bank of the De Grasse (or Grasse) river, about forty miles above its junction with the St. Lawrence river. The village was incorporated in 1845. The population has increased steadily during the past few decades, until it now numbers about 3,500. The village is well provided both with a sewerage system and a water supply, the latter being pumped from the De Grasse (or Grasse) river at a point about three-quarters of a mile above the village.

The pumping plant was constructed in 1889. Two intake pipes, ten inches in diameter, lead to the plant from a point in the river 100 feet from shore and three feet above the bed of the stream. These pipes enter a screening chamber constructed for the purpose of removing from the water the pulp and other suspended matters carried by the stream. The screen chamber was not installed when the plant was first constructed but was added later, in the year 1906, at a cost of $2,000, and has been in operation since December, 1906. This screen chamber is provided with three sets of screens, each having fourteen meshes to the linear inch, and a combined area of forty-eight square feet.

The average water consumption of the village is 300,000 gallons; the quantity ranging from a minimum of 255,000 gallons per day to a maximum of 425,000 gallons per day. The water is pumped to a stand pipe located in the northeasterly section of the village, having a capacity of 170,000 gallons. The system serves an estimated population of 3,000 persons.

In examining into the effect which any pollution of the De Grasse (or Grasse) river may have upon the health or comfort of the residents of Canton individually, or upon the municipality as a whole, in relation to its use of the river for a public water supply, it is necessary to consider separately the two classes of wastes which are discharged into the river, viz., the domestic sewage and the industrial wastes. As stated quite fully in my recent report to you upon the Upper Hudson river, these two classes of sewage have very distinct effect in their influence upon health and life; the domestic sewage affecting essentially the question of public health and the transmission of disease; and the industrial sewage, affecting health in a very slight degree, but public comfort and convenience in a very marked degree. On this account, a careful distinction was made in this investigation, between these relative amounts and effects of the discharge of these two classes of sewage into the De Grasse (or Grasse) river.

In respect to domestic sewage, it was found that only a small amount was discharged into the De Grasse (or Grasse) river above Canton. The population upon the watershed is mostly scattered, and of the small villages and hamlets that are located upon the river and its tributaries, none were found to be provided with modern sewerage improvements. The most important direct pollution of this nature was found to be from the employees of the De Grasse Paper Company, which is discharged into the river along with the industrial wastes. This pollution is a direct menace to health and life of the inhabitants of Canton and should water-borne diseases break out among the employees a direct infection of the unprotected water supply of Canton might follow.

With respect to the pollution of the river by industrial sewage, it was found that the only plant contributing any considerable pollution of this class was the De Grasse Paper Company at Pyrites. There is, however, at Hermon, which is located on the watershed, a pyrites mine that was in operation at the time of the inspection, from which a small amount of mine waste was discharged into Elm creek, a tributary which enters the De Grasse (or

Grasse) river about one mile below Pyrites and six miles above Canton. These two sources of individual pollution will be taken up and described separately.

The plant of the De Grasse Paper Company, which is the principal source of industrial pollution, is located on the right bank of the De Grasse (or Grasse) river in the hamlet of Pyrites, about six miles above the village of Canton. This plant is composed of a paper and two pulp mills employing two distinct processes of pulp manufacture, known as ground wood pulp and sulphite pulp respectively. Many years ago a ground wood pulp mill under the name of the High Falls Pulp Company occupied the present site, and this mill after continuing its operation for a number of years was finally abandoned. In 1896 the present sulphite pulp mill was constructed and operated under the title of the Pyrites Paper Company. In April, 1903, the De Grasse Paper Company was organized, and became successor to the Pyrites Paper Company, and at that time constructed in addition to the sulphite pulp mill the present paper and ground wood pulp mills. These latter were completed and put in operation in April, 1904.

A report of the condition and operations of this plant, in which the capacity of the three mills comprising the plant is stated to be the same as at the present time, was submitted to this Department on July 3, 1903, in accordance with section 79a of the Public Health Law. This report was returned for additional information, was resubmitted and was finally accepted and placed on file in this Department on February 2, 1904. The total number of employes at present is about 125. The president of the company is J. A. Outterson of Pyrites; the vice-president is J. H. McCormick, Pyrites; the secretary is J. D. De Cant, Pyrites; and the treasurer is L. P. Lehr, Pyrites. The superintendent of the plant is A. L. Bernier, Pyrites.

The capacity of the plant is about thirty tons of sulphite pulp, fifteen tons of ground wood pulp and thirty-five tons of No. 1 bag paper daily. At the present time the average production is about twenty-five tons of sulphite pulp, of which fifteen tons are sold and ten tons are used in the production of paper. The average output of ground wood pulp is about seven tons per day. During three or four of the summer months the production of ground wood pulp generally decreases from a maximum of from twelve to fourteen tons to six or seven tons, and during a portion of the summer season, depending on the water power available, no ground wood pulp is produced.

The various processes employed at the plant may be considered under three heads:

1. Sulphite pulp process.
2. Ground wood pulp process.
3. Paper manufacture.

Since these processes have been described in much detail in my previous report to you upon the pollution of the Upper Hudson river, to which reference is respectfully made, and since the processes in the case of the De Grasse Paper Company's mill are similar in them in nearly every respect, only a brief description of them will be given here.

In both the sulphite and the ground wood process, the preparation of the wood is the same; the bark being removed in each case and the wood cut into sticks of appropriate length to be used in the chipping machines or grinders. In the sulphite process these sticks thus prepared are passed through the chipping machines which cut them into small chips and they are then placed in the digestors, these chips being of a suitable size to be acted upon and chemically disintegrated by the sulphite liquor. In the ground wood process these sticks are placed directly in the grinding machines, they being cut of a size to properly fit these machines.

In the sulphite process the sulphuric acid which is used in digesting the chipped wood is produced by the vacuum process in which the fumes of burning sulphur are drawn through a milk of lime solution. The fibre separated by the digesting process is then washed in brick-lined, steel tanks and the waste sulphite liquor washed from the fibre is discharged directly into the stream. In the washing of the pulp, some of the finer fibres are lost but the amount may be considered to be relatively very small. In the production of each ton of sulphite pulp about 225 pounds of lime and 290 pounds of sulphur are used. The lime and sulphur are not reclaimed so that practically all of these chemicals together with the dissolved liquor and other woody constituents are discharged directly into the river.

The sulphite pulp is pumped from the washing vats and passed over rolls or presses, the surplus water which carries the pulp being taken out through screens having sixty-five meshes to the linear inch. There are five of these presses. About 25 per cent. of the white water (or waste water), from three of the presses, is passed through a screen having forty meshes to the linear inch, before being finally discharged into the stream. Again 25 per cent. of the white water, from two of the presses, containing a considerable amount of finer woody fibres, is also discharged 'irectly into the stream. The remaining 75 per cent. of the white water, it was estimated, is passed to the pulp washing tank.

In the ground wood process the pulp which comes from the grinding machines is carefully screened to remove all coarse slivers and fibres and is then stored in a " stock vat " from which it is pumped to the paper machine as required. The slivers and coarse fibre collected from the screens are stored in piles outside of the mill and burned at intervals.

At such times as the supply of ground wood pulp is greater than that needed to supply the paper machines, it is pressed into sheets on screening rolls. The water extracted from the pulp by these rolls, which is generally known as "white water," contains a considerable amount of pulp fibre, which, if it were not used over again, would be discharged into and pollute the stream. It is claimed that this "white water" is used over again in the processes of grinding and is not discharged directly into the stream. The rolls, two in number, were not, however, in operation at the time of the inspection, so that no evidence could be obtained in reference to them.

In the process of manufacture of the paper, the pulp is pumped to the paper machines from the " stock vat " as previously described. Before passing onto the rolls, the pulp is first passed through the wet machine which is provided with screens having sixty-five meshes to the linear inch. These screens extract a large percentage of the surplus water from the pulp, but do not remove all of the fibre. The waste water from the wet machines then carries a certain amount of fine fibre together with the surplus of clay, " sizing " (which consists of resin and soda ash), alum and aniline dyes which are not taken up by the pulp in this portion of the process. A large percentage of this waste water is caught by a " saveall " placed under the screens and is retained and used over again in other parts of the process.

Another portion of the waste water from the wet machine is obtained from the horizontal screen that carries the pulp to the paper rolls. This screen is washed at two points by showers or sprays located below the " saveall " near opposite ends of the wet machines. The first shower nearest the rolls relieves the screen of the greater portion of the pulp which clings to it. It was estimated that 90 per cent. of this pulp-carrying water was used again in the beaters or carried to the " Decker " machine in the grinding room. This machine is a rotary one, provided with a supporting screen of fourteen meshes to the linear inch, and an outside screen of sixty-five meshes to the linear inch. The white water from the paper machine, which is passed through this machine, is used over again in the grinding process.

The second shower near the " wet end " of the machine relieves the screen of additional pulp adhering to the screen and produces a white water which, together with 10 per cent. of the white water from the first shower, is passed to a second Decker machine in the finishing room. From this Decker machine the white water passing the screens, and carrying the fine fibre, clay, etc., is discharged directly into the stream and constitutes the only direct pollution of the stream from the ground wood pulp and paper making processes.

It will thus be seen that the sources from which white water, or the water carrying wood fibre, is derived and discharged directly into the stream, are from the sulphite pulp rolls, the second Decker machine receiving the white water from the second shower at the paper machine, and a portion of the white water from the first shower. It is claimed by the officials of the company that in all of the other processes the white water was used over again and was not discharged directly into the river, and the inspection seemed to bear out this claim.

Summing up, then, with respect to the character and amounts of industrial pollution discharged into the river by the De Grasse Paper Company from the three processes employed in the plant, it may be said:

1. In the sulphite mill, practically all of the lime and sulphur used in the process is discharged into the stream in the form of free sulphurous acid or in combination with woody refuse dissolved from the wood. There is also an inconsiderable amount of the finer sizes of pulp derived from the process of washing the pulp, and a considerable amount of wood fibre derived from the pulp rolls or presses.

The amount of lime and sulphur discharged into the stream daily is estimated to be about 5,600 pounds of the former, and 7,250 pounds of the latter. The woody refuse contained in the waste sulphite liquor and discharged into the stream is estimated to be about 60,000 pounds on the basis used in the former investigations referred to above.

In regard to the question of lost fibre discharged from the sulphite mill, it may be said that in the former investigations referred to data were collected and estimates made of the probable loss of fibre from the pulp rolls or presses. From the percentages of loss, determined during these investigations, it is estimated that the wood fibre discharged from the sulphite pulp process of the De Grasse Paper Company, including the waste from the rotary screen in the sulphite pulp mill, amounts to about 550 pounds daily.

2. In the ground wood pulp mill, it was claimed that practically no wood fibre was wasted or discharged directly into the stream. This claim is corroborated by the conditions of operation of the plant, insomuch as under ordinary conditions the pulp is delivered directly to the paper machine from the stock vat, and is not pressed into sheets and stored for future use; and, further, from the fact that the water from the Decker machine in the grinding room and from the rolls or presses, when such presses are in operation, is used again in the grinding process.

3. In the paper mill, while the loss of pulp is relatively small owing to the use of the " saveall " and the Decker machines, a certain amount of wood fibre is discharged into the stream. According to the information obtained from the investigations above referred to and considering the operating conditions of the plant during the inspection, it is estimated that about 1,200 pounds of of wood fibre is discharged into the river daily from operations carried on in the upper mill.

Taking up now the question of the wastes from the pyrites mine, previously referred to, it was found that this mine was located in the village of Hermon on the east bank of Elm creek, a tributary of the De Grasse (or Grasse) river, and was operated by the St. Lawrence Pyrites Company. The company employs about 175 men in the operation of the iron mine and the ore-crushing plant connected with it.

Iron mining was first carried on at this point in 1881. At present two shafts are being worked, and from 225 to 250 tons of iron ore are being crushed daily. The crushed material is discharged into troughs into which streams of water are running and from which the ore settles out and the crushed rock is then transported to waste piles near the stream. About 1,000 gallons of water are used per minute in the process, and this water ultimately drains from the refuse piles and discharges into Elm creek. The appearance of the waste water discharged from this process does not indicate any chemical pollution owing to the fact that the water is in contact with the crushed ore for only a short period of a few minutes.

Although the water from the above process does not contribute any appreciable pollution, there is, however, a certain amount of water pumped from the mine that produces some pollution. This mine water has a yellowish tinge, and apparently contains compound of iron derived from the ore. The amount of this mine waste discharged into the creek is, however, small, since only about 8,000 gallons per day is pumped from the mine. The pumps, which drain the two shafts which are worked, operate only about one hour daily on an average.

The drainage area of Elm creek above the point of discharge of this mine waste is thirty-three square miles. With an estimated low summer flow of about six cubic feet per second, the mine waste would be diluted 500 times while at other seasons the dilution would be many times greater than this. This large dilution readily accounts for the entire absence of any visual pollution in Elm creek below the point of discharge from this mine.

The effect upon the stream of the discharge of wastes from the plant of the De Grasse Paper Company and the iron mine at Hermon, as evidenced by careful inspection and by chemical and bacteriological analyses of the water, will now be briefly described:

The water in the river above the plant of the De Grasse Paper Company was clear, though showing a considerable degree of natural color, characteristic of most Adirondack streams. There was little or no turbidity and no suspended matter or particles. Below the plant the effect on the river of the mill pollution was very apparent. The water in the stream was turbid and highly colored and covered with patches of foam, frequently observed below points of discharge from sulphite pulp mills. Both appearances and odor were characteristic of sulphite liquor, and the water when collected in a glass contained a considerable amount of suspended matter readily identified as wood fibre. At the intake of the Canton water supply, the color, turbidity, and suspended matter in the water had been so reduced as to be barely perceptible to the naked eye, owing, doubtless, to the fact that slack water in the stream for a distance of a mile or more above the intake afforded good opportunity for considerable sedimentation.

Since particular attention was called by the petitioners to the effect of this pollution upon the character and wholesomeness of the water supply, the condition of the water at the pumping station was carefully inspected. Although the suspended fibre was only slightly apparent in the water in the intake, an examination of the screens in the screen chamber indicated that considerable wood fibre was carried in the water, since the screens were coated with a slimy deposit composed for the most part of a filamentous substance that was undoubtedly wood fibre. At this point the fibre, instead of being white, was of a reddish brown color, while the sediment at the bottom of the screen chambers was very dark colored. This sediment, which during a period of two months, had collected to a depth of four or five inches, was of a jelly-like consistency and though containing some sand and loam was composed mostly of fibrous matter apparently pulp fibre.

It was claimed by the engineer of the pumping plant that the amount of pulp fibre carried in the water during the summer is much less than at other times of the year, owing to the mill not running full time on account of low water, and it is only necessary at that season to clean the screens about once a week. During the fall and winter, however, when the flow of the stream is well maintained and the mill runs full time, it is necessary to clean them as often as once a day. At certain times in the spring, during high water, it is found necessary to clean the screens about once in two hours. This is probably the result of a scouring action which brings into suspension the chemicals, pulp fibre and other wastes which have been deposited during times of low water.

During the operation of cleaning the screens, it is necessary to pump down the water in the screen chamber, and in doing this a steam siphon is used in the latter stage of the process. At such times an unmistakeable odor of sulphite liquor is noticeable, indicating clearly the character of the sediment caught by the screens.

The water from the taps in the village was also examined and was found to contain suspended matter closely resembling the fibre that was found in the water below the plant. It was stated that in many instances it has been necessary to entirely replace the plumbing of houses in the village by reason of the coating of the pipes with this material.

In order to supplement the above observations of the character of the water in the stream with respect to both industrial and domestic sewage pollution, chemical and bacteriological analyses were made at sampling stations so selected as to show the changes in the quality at various points above and below the mill. Station No. 1 was at a point on the De Grasse (or Grasse) river about one-eighth of a mile above the upper mill. Station No. 2 was at a point on the De Grasse (or Grasse) river about 800 feet below the plant and above the junction of Elm creek. Station No. 3 was on Elm creek about 800 feet above the confluence with the De Grasse (or Grasse) river. Station No. 4 was on the De Grasse (or Grasse) river about 1,200 feet below the junction of Elm creek. Station No. 5 was at the pumping plant of the Canton water works, this sample being taken from a tap on the discharge main from the pumps.

It will be seen from a comparison of the analyses, appended herewith, that the water in the stream above the paper company's plant, though highly colored, is free from any considerable amount of pollution of an industrial nature, as shown by the low ammonias and by the constituents showing the amounts of nitrogenous and carbonaceous matter. The bacterial counts and the presence of

B-Coli indicate, however, some pollution from domestic sewage or from surface washings of cultivated fields. Owing to the relative high water in the river at the time of the inspection, and the small population sewering directly into the river it is probable that the high bacterial counts and presence of coli were due principally, if not wholly, to surface washings.

The analyses of the sample collected just below the mill indicates very clearly the full extent of the pollution caused by wastes from the mill. The "total solids" have been increased from 64 to 130 parts per 1,000,000, while similar increases appear in the "loss on ignition" and "oxygen consumed" indicating that the organic matter is principally carbonaceous, derived from the dissolved and suspended wood pulp. This increase is more than 100 per cent. in the first two cases and over 600 per cent. in the last case. The suspended matter present, as stated in the analyses, is largely fibrous matter of a woody nature.

The analysis of sample No. 3, collected from Elm creek above its junction with the De Grasse (or Grasse) river, indicates by the low "ammonias" and "oxygen consumed" that there is very little if any organic pollution, either from domestic sewage or from other sources. The water is, however, noticeably turbid, but as shown by the "turbidity," the "total solids" and "mineral residue," it is due almost entirely to mineral matter; probably in part to surface washing of soil and in fact to the pulverized rock from the mine crushers.

The analysis of sample No. 4 shows clearly the evidence of the same pollution indicated by the analyses of sample No. 3, though lessened somewhat in its effect by the admixture of the Elm creek waters which is organically of much purer quality. The "color," "loss on ignition," "mineral residue," "oxygen consumed" and "hardness" of sample No. 4 are all intermediate between the same constituents in samples No. 2 and No. 3, as would be expected. This analysis also affords a better opportunity for comparison with the sample No. 5, collected at the pumping station, since, owing to the difference in quality of the Elm creek water and the river water to which it is added, the analyses of the river water above Elm creek and at the pumping station are not directly comparable.

The analysis of the sample collected at the pumping station shows by nearly every constituent in the analysis that some reduction takes place in the pollution, due to sedimentation, dilution and other natural causes in the travel of the water from the paper mill to the pumping station. This is shown more noticeably by the reduction in the "turbidity" and "total solids" which, in the section of the river referred to, have an opportunity to settle out. The small reduction in "loss on ignition" and the "oxygen consumed" and the presence of high bacteria, B-coli and "fibrous matter," all indicate, however, that the domestic and industrial wastes discharged from the paper company's plant have reached the intake of the Canton water supply and seriously affected its quality.

I hereby report my examination, pursuant to the provisions of your order, and after a careful consideration of all the facts in the case bearing on the questions involved, I report the results thereof to you within the time prescribed therefor, as follows:

I hereby find and certify the following facts:

1. That the De Grasse (or Grasse) river is seriously polluted by the domestic sewage and industrial wastes derived from the employees and the various processes used in the manufacture of paper and pulp, of the De Grasse Paper Company. The amount of domestic sewage pollution is that contributed by the 125 hands employed in the mills. The amount of industrial wastes is estimated to be about 13,000 pounds of mineral wastes, consisting principally of lime and sulphur compounds, and 62,000 pounds of organic wastes, consisting principally of dissolved woody matter or of finely divided pulp fibre, daily.

2. The effect of the *domestic sewage* pollution derived from the De Grasse Paper Company's mill and other sources of domestic sewage pollution above the village of Canton is to create a menace to the purity of the unprotected water supply of the village of Canton, depending upon the prevalence or outbreak of water-borne diseases among the mill employees, or in families who discharge their sewage directly into the river. Owing to the large number of employees in the mill of the De Grasse Paper Company, and its proximity to the intake of the Canton water supply, the danger

of contamination from this source is very much greater than from other sources existing upon the watershed.

3. The effect of the discharge into the De Grasse (or Grasse) river of the *industrial wastes* from the various processes of manufacture of pulp and paper in the De Grasse Paper Company's mill upon the quality of the stream and upon the health and comfort of the inhabitants of Canton, judged from observation and from chemical and biological examination of the water at different points, at the time of this investigation, was not such as to produce a condition of offense in the stream, nor to interfere with the enjoyment of the use of the stream for other than water supply purposes — although at times of low stages of water in the river the effect of this pollution would probably be such as to produce offense. The pollution at the time of this investigation was, however, sufficient to seriously affect the quality of the water of the Canton water supply by reason of the suspended matters and wood fibre discharged into the river by the De Grasse Paper Company.

4. The wastes discharged into Elm creek from the iron mine at Hermon was not in amount sufficient to produce any visual pollution of this stream below the point of discharge nor to affect in appreciable amount the chemical quality of this water; nor were these mine wastes of a nature to affect hygienically the quality of the Canton water supply.

I hereby find and certify that the conditions existing in the De Grasse (or Grasse) river constitute a public nuisance for the reason that the public water supply of the village of Canton, N. Y., is injuriously and seriously affected and polluted thereby and that this is caused by the discharge into said river of domestic sewage from the De Grasse Paper Company's mill and industrial wastes from said plant.

I hereby find and certify that the discharge of said domestic sewage from said plant of the De Grasse Paper Company, and of such industrial wastes from such plant, constitutes a public nuisance.

Respectfully submitted,

EUGENE H. PORTER,

Commissioner of Health

TABLE SHOWING SANITARY ANALYSIS OF WATER

To Accompany Report on Pollution of the De Grasse (Grasse) River

	Sample No. 1.	Sample No. 2.	Sample No. 3.	Sample No. 4.	Sample No. 5.
Color	55	55	33	45	45
Odor, hot	2 musty	3 woody	3 musty	3 musty	3 musty
Odor, cold	2 vegetable	2 vegetable	1 vegetable	1 sweetish	1 vegetable
Turbidity	1	13	15	13	3
Solids, total	64	130	130	88	76
Loss on ignition	37	88	27	41	33
Mineral residue	27	42	103	47	43
Nitrogen as ammonia free	.020	.020	.024	.020	.004
Nitrogen as ammonia albuminoid, total	184	.200	.252	.160	.118
Nitrogen as nitrites	.002	Trace	Trace	Trace	Trace
Nitrogen as nitrates	.20	0.16	0.16	0.16	0.16
Oxygen consumed	10.8	58.5	8.60	14.80	13.00
Chlorine	0.75	0.95	1.40	0.80	0.90
Hardness, total	26.6	40.3	79.3	50.7	50.7
Remarks	No fibrous material.	Contains considerable quantity of coarse fibrous material. Also contains some very fine shreds of wood.	Turbidity is not due to fine fibrous material but to amorphous matter.	Contains considerable quantity of coarse fibrous matter.	Contains fibrous material in small amounts; some coarse fibres.
Total bacteria per cc	375	1,000	1,600	800	1,000
B. coli communis	in 1-10 cc.,	in 1-10 cc.	in 1 cc.	in 1-10 cc.	in 1 cc.
(Preliminary report)	1 tube.	2 tubes	3 tubes	2 tubes	1 tube

BALLSTON SPA

POLLUTION OF KAYADEROSSERAS CREEK

ALBANY, N. Y., *February* 6, 1907.

DR. EUGENE H. PORTER, *Commissioner of Health, Capitol, Albany, N. Y.:*

DEAR SIR:— I am instructed by Governor Hughes to inclose to you a communication from Frank Whalen of February 2, 1907, concerning the alleged disregard of an executive order issued by Governor Roosevelt forbidding the further pollution of the Kayaderosseras creek, with the request that you give him such information in the premises as you may have at your disposal.

Very truly yours,

E. W. HUFFCUT,

Counsel to the Governor

BALLSTON SPA, N. Y., *February* 2, 1907.

Hon. CHARLES E. HUGHES, *Executive Chamber, Albany, N. Y.:*

DEAR SIR:— We ask your attention to this situation here:

About 1899 the State Board of Health investigated the pollution of the Kayaderosseras creek and Saratoga lake by the village of Ballston Spa, tannery and sulphite mill. On the report of the Board, Governor Roosevelt issued an order under section 6 of the Public Health Law commanding the offenders to cease from discharging their effluents and sewage into said creek. No attention has ever been paid to that executive order, and no attempt has ever been made to enforce it by the State or local boards of health. The village of Ballston Spa is now putting in a sewage disposal plant. No disposal works have ever been put in by the sulphite mill, which is owned and operated by the Union Bag & Paper Company. On the contrary, about three years after Governor Roosevelt issued his order, the sulphite people enlarged their sulphite plant to double its former capacity and continued to, and do now, discharge all the increased effluent into the Kayaderosseras creek. This stuff settles on the bottom of the creek and in times of high water lodges on our meadows, pollutes the grass so our cattle will not eat it as pasture, or when made into hay; pollutes the water so cattle will not willingly drink the water and if they do drink it, bad milk and butter are the result; fish cannot live in the water; ice in winter is too dirty to use; the stench pollutes the air; the deposits poison the earth so that our meadows do not produce in quantity or quality the grass and hay that they yielded ten years ago, and the hired help object to working on our farm.

We own about 260 acres, situate one and one-half miles below the village of Ballston Spa, 200 acres of which are subject to overflow and these polluted deposits. We refer you to Dr. Willis G. Tucker, of the Albany Medical College, who once made an examination on our meadows and along the creek. Also to Dr. E. J. Wheeler, 79 Chapel street, Albany, Chemist to the State Board of Agriculture, who is also familiar with some of the facts, he having been employed by the sulphite people at one time.

Yours truly,

FRANK WHALEN

ALBANY, N. Y., *February* 13, 1907.

Hon. CHARLES E. HUGHES, *Governor, Albany, N. Y.:*

SIR:— I have the honor to report to you in response to your instructions of February 6, 1907, with which you inclosed a communication from Frank Whalen, Esq., of February 2, 1907, concerning *the alleged disregard of an executive order issued by Governor Roosevelt forbidding the further pollution of the Kayaderosseras creek.*

The proceedings in this case were started by a petition made to Governor Black, dated October 1, 1898, and signed by a number of residents of Saratoga county.

This petition alleged that the waters of Saratoga lake were polluted by the discharge of sewage from the villages of Saratoga Springs and Ballston Spa, and from the discharge of chemicals and refuse from certain manufacturing establishments located in or near the village of Ballston Spa.

Governor Black directed the State Board of Health to investigate the matter.

It was referred to the Consulting Engineer and report made by him, dated December 14, 1898, which verified the complaint and recommended that a thorough investigation be made by the State Board of Health, or a committee thereof, having power to subpoena witnesses.

This report was transmitted to Governor Black December 22, 1898.

(The documents above referred to are found in the Nineteenth Annual Report for the year 1898, at page 107.)

Mr. T. F. Hamilton, of Saratoga Springs, N. Y., attorney, sent a verified petition to Governor Roosevelt, dated January 6, 1899, which recited the facts above stated and alleged that he, Mr. Hamilton, represented the property-owners who had heretofore petitioned; and asked that the State Board of Health be directed to make an examination and report on the facts in the case.

On this petition, Governor Roosevelt made an order, dated the 16th of February, 1899, reciting the above facts and requiring the State Board of Health, in accordance with the provisions of section 6 of article 1 of the Public Health Law, to make an examination into the alleged nuisances and report the result thereof to him on or before the 10th day of March, 1899.

Pursuant to the above order, the State Board of Health had a hearing at which testimony was taken and a report made to the Governor, dated March 22, 1899, submitting the testimony taken together with the following findings of fact and recommendations:

"I.

"That Saratoga lake is about six miles in length, extending in a northeasterly and southwesterly direction, and is surrounded by the townships of Malta, Saratoga Springs, Saratoga and Stillwater. It is about four miles east of Ballston Spa and about the same distance east, and a little south, from the village of Saratoga Springs. Its principal inlet is the Kayaderosseras creek and its outlet is Fish creek, which flows northeasterly into the Hudson river. Its inlet, Kayaderosseras creek, is a tortuous stream flowing in an easterly direction through the village of Ballston Spa and the intervening farming section to the lake. Several smaller streams or brooklets converge and flow into it near the village of Ballston Spa, and the public and private sewers and drainage of said village also empty into it.

"II.

"That along the banks of said creek and its tributaries are located several large manufacturing plants engaged in the manufacture of paper, sulphite pulp, and in tanning leather, and the effluent and manufacturing refuse from these manufacturing plants are discharged into the Kayaderosseras creek, so that said creek is practically an open sewer, from Ballston Spa to the lake.

"III.

"The tannery which discharges its effluent through a small brook or arm, known as Gordon creek, is located within the village of Ballston Spa, and is owned by Messrs. Hall, Haight & Company, a copartnership employing about 350 men. It is engaged in tanning and finishing all kinds of leather, and its yearly output in value is $1,750,000. The establishment was started in the year

1881, and the process of tanning is briefly described as follows: The hides are put into vats of fresh water and allowed to soak four days for the purpose of removing the salt, then they are put into lime pits, where they are handled over every day for six days. From there they go into what is called a depilatory condition, for the purpose of neutralizing the lime after the hair is removed. Next they are put into the bark liquor, made from water passed over ground hemlock bark, and from there they go into the finishing shop. The water used in soaking the hides containing a large quantity of salt, the lime-water, and the liquid from the depilatory process, which is lime-water neutralized by lactic acid, and the tanning liquors, are all discharged finally through a box sewer into the creek, and the effluent so discharged is highly colored and can hardly be claimed to be free from pollution.

"IV.

"There are also several mills engaged in the manufacture of paper and sulphite pulp, located on or over the banks of said stream, and owned by the George West Paper & Bag Company, a domestic corporation incorporated pursuant to the laws of the State and having a capital stock of $500,000. The mill known as the 'Glen mill' is engaged in the manufacture of sulphite pulp. The amount manufactured is more than a hundred tons per week. The process is briefly described as follows: From 150 to 200 cords of wood are ground up each week and the chip or shred is put into large digesters, lined with lead, where it is treated with hot sulphurous acid and other chemicals, which subdue the resin and vegetable nature of the wood and leave the fibre free, which is removed and further treated with chloride of lime and other chemicals. About 300 pounds of sulphur is used for the manufacture of a ton of pulp. Large quantities of chloride of lime and other chemicals are also used and the effluent from the mill is ultimately discharged into the Kayaderosseras creek.

"V.

"That nearly all the water of said creek is carried through one or all of these mills, and after acting as a solvent or agent in chemical processes, finds its way back into the stream, carrying in solution acids, alkalies, organic and inorganic matter, in such large quantities that a decidedly acid reaction can be detected in the waters of said creek from three to four miles down the stream. These acids and alkalies coming in contact with the large quantities of sewage discharged into this stream hasten chemical action and fermentation, thereby generating gases and giving off odors which are offensive to smell, often producing nausea and affecting the comfort, if not the health, of those obliged to inhale them.

"VI.

"That into the said Kayaderosseras creek is also discharged through a trunk sewer, open and closed, the sewage of Saratoga Springs, a village varying in population from 10,000 in winter to over 100,000 in summer.

"VII.

"That the shores of Saratoga lake are lined with farmhouses, cottages and hotels, where thousands of people go in the summertime for pleasure, and the sewage and domestic wastes of these hotels and cottages are discharged into the lake, and those who complain most bitterly about its pollution seem to forget the ancient rule established in Jerusalem, that each person should sweep before his own door.

"VIII.

"That Saratoga lake is polluted in the manner above described, and the sewage, wastes, refuse matter, fish that die from natural causes, as well as those killed by the contamination of the water, are washed upon the shores, dockings and pilings, and during the warm summer months ferment and decay, producing stenches more or less offensive, according to the customs and habits of those obliged to inhale them.

"IX.

"That the waters of Kayaderosseras creek and Saratoga lake are not directly used for potable purposes, but ultimately find their way through Fish creek into the Hudson river, which is the source of many potable water supplies, and in this way one of the most perplexing and serious problems affecting the life and health of the people of our State is presented. Many of the creeks and streams of the State, the waters of which were fresh and pure twenty-five or fifty years ago, and were used for power purposes only, have come to be little more than open sewers, transmitting disease germs from one place to another, filling up ponds and reservoirs with refuse matter, destroying or driving away fish, emanating offensive and disagreeable odors, affecting the riparian interests of those owning property along their banks, and depriving them of the use of pure and wholesome water.

"X.

"That the hotel proprietors and cottage-owners along the shores of the lake, the millowners along the banks of the inlet to said lake, and the villages of Saratoga Springs and Ballston Spa are creating and maintaining a nuisance injurious to the fullest and freest enjoyment of the property rights of those living along the shores and banks of said lake and stream, as well as a nuisance, indirectly, affecting the public health in the manner aforesaid.

"CONCLUSION.

"That State Board would, therefore, make the following recommendations, based on the foregoing findings of fact:

"I.

"That the hotel and cottage proprietors owning property along the shores of said lake and discharging raw sewage and domestic wastes into the waters thereof, be required to collect and dispose of the same in a sanitary manner, to be approved by this Board, and that after July 1, 1899, the discharge of any raw sewage into the waters of said lake by said proprietors shall be declared a nuisance and ordered abated by the Governor.

"II.

That the villages of Saratoga Springs and Ballston Spa, either individually or collectively, be required to put in disposal works, subject to the approval of the State Board of Health, on or before April 1, 1900, and that the discharge of raw sewage into the waters of Kayaderosseras creek or Saratoga lake, after said date, shall be declared a nuisance injurious to public life and health, and that the same be abated by order of the Governor.

"III.

That the discharge of the effluent and waste from the tannery, owned and operated by Messrs. Hall, Haight & Company, through Gordon creek into Kayaderosseras creek, be declared a nuisance and ordered abated on or before April 1, 1900, unless the effluent shall be treated in a sanitary manner to be approved by the State Board so as to render the same innocuous.

"IV.

"That the discharge of the effluent and waste from the paper and sulphite mills, owned and operated by the George West Paper & Bag Company, into Kayaderosseras creek, be declared a nuisance and ordered abated on or before April 1, 1900, unless the effluent shall be treated in a sanitary manner to be approved by the State Board so as to render the same innocuous."

The foregoing was adopted as the report of the State Board of Health at a meeting held March 22, 1899.

On March 30, 1899, Governor Roosevelt made an order, in which he recited all the facts in the case together with the findings of fact submitted by the State Board of Health; and said order further approved the said report and ordered that all hotels, cottages, etc., on Saratoga lake should discontinue the discharge of raw sewage into the waters of the lake on or before July 1, 1899; that on or before April 1, 1900, the village of Saratoga Springs and the village of Ballston Spa should put in disposal works for the sanitary treatment of sewage of the said villages, upon plans to be approved by the State Board of Health; that the discharge of the effluent and waste material from the tannery owned by Hall, Haight & Company, and from the sulphite mills owned and operated by the George West Paper & Bag Company be ordered abated and discontinued before April 1, 1900, unless it be treated in sanitary manner according to a process to be approved by the State Board of Health.

Governor Roosevelt was notified July 19, 1899, that notice had been served upon all these parties by publication of the conditions of this order.

I beg to present herewith a copy of the order of Governor Roosevelt requiring the State Board of Health to make this investigation, dated February 16, 1899, together with a copy of the order above referred to directing the discontinuance of the conditions found to exist, said order being dated March 30, 1899.

(The documents above referred to will be found in the Twentieth Annual Report of the State Board of Health, at page 61.)

Your instructions to investigate the present conditions were received February 6, 1907, and I immediately directed one of my engineers to make a personal investigation of the conditions.

This was done on February 7, 1907, and, from such investigation, I am able to give you the following facts:

The sulphite mill, to which the complaint of Mr. Whalen refers, was formerly owned and operated by the George West Paper & Bag Company, but is now owned and operated by the Union Bag & Paper Company.

In the year 1899, while the plant was operated by the George West Paper & Bag Company, there was in operation three "digesters" or vats in which the fibre of the ground wood was separated from the lignin. These digesters were ten feet in diameter and thirty feet in height and their combined capacity was about 7,070 cubic feet. At that time the plant produced somewhat more than 100 tons of sulphite pulp per week or about seventeen tons per day, and from twenty-five to thirty-five cords of wood were ground up and converted into pulp daily.

In 1902, after the plant came under the control of the Union Bag & Paper Company, an additional digester, fifteen feet in diameter and thirty-nine feet high, was constructed. The capacity of this digester is 6,890 cubic feet, making the total capacity of the four digesters in use at the present time about 14,960 cubic feet. Also, the daily output of the mill since 1902 has been fifty tons of sulphite pulp daily requiring, approximately, more than

100 cords of wood daily. The mill is operated during both day and night.

The superintendent stated that about 6,000 pounds of sulphur and about 6,850 pounds of lime were used daily in the process of manufacture. The operation of the plant during a part of the process, as described by the superintendent, follows:

First, the wood is ground and the digester filled full of the ground wood. Then the tank is filled two-thirds full with a hot acid solution containing bisulphite of lime. After the ground wood is " digested " or its fibres separated from the resin binding the fibres together, the whole contents of the digester is blown off into a washing tank.

During the process in the digester, owing to the formation or presence of sulphurous acid gas in the digester, it is necessary to relieve the digesters of a part of the gas and dissolving liquor. This portion of the gas and dissolving liquor is piped to an acid supply or storage tank in which the digesting solution is stored, after being manufactured, until it is needed in the digesters.

As soon as the contents of the digester are blown into the washing tank, clear water is added to wash the fibre or pulp free from the acid and wood resin. The liquor portion of the charge blown off from the digester, which contains dissolved lignin and sulphite of lime, together with the clear water which is added in the washing tank, is then drawn off through a pipe at the bottom of the washing tank in three stages:

1. For a time, while the liquor flowing from the washing tank maintains a certain standard strength, it is drawn off and returned to the acid supply tank;

2. When the liquor flowing from the washing tank becomes too weak, on account of the clear water which is being added, to be returned to the acid supply tank, it is carried in barrels to the boiler-room and there evaporated, through a water tube boiler, to the consistency of heavy oil which is sold to foundrymen; this is continued until a certain point is reached when the liquor is too weak to render evaporation profitable;

3. Finally the washing tank is emptied entirely of liquid and the effluent discharged directly into the stream.

The superintendent was either unable or unwilling to furnish any estimate of the volume of the flow from each of the three washing tanks during the separate stages of discharges as above described, or any estimate of the proportionate volume during each stage of the discharge. He stated, however, that, with the capacity of the evaporating apparatus and methods, it was possible to treat one-half the flow from the washing tanks during the second stage of discharge. This treatment by evaporation of a portion of the effluent from the washing tanks has been carried on for about two years and the superintendent stated that during the past eight months, since he has been in charge of the plant, approximately one-half of the effluent flow during the second stage of discharge from the washing tanks had been subjected to the evaporating process.

The facilities for carrying on evaporation are very crude. The liquor must be caught in pails from a pipe at the bottom of the washing tanks which are located in a narrow pit, turned into barrels and carried to the boiler-room. At the time of the inspection, only one washing tank was being discharged and the flow from this tank was said to have reached the third stage so that the discharge was turned directly into the stream.

The water tube boiler in which evaporation is accomplished was pointed out. The fire was up and a small stream of clear water was being turned through the tubing system to preserve the tubes.

It would be impossible, without an extended study and inspection of the operation of the plant and the co-operation of a chemist, to determine definitely the amount of polluting matter being discharged into Kayaderosseras creek from this sulphite pulp mill; but it is evident from the foregoing description of the operation of the plant that the treatment or purification of the polluted wastes as carried on at the plant is not complete.

I also collected the following information regarding the trade wastes from the *tannery of the American Hide & Leather Company, formerly operated by Hall, Haight & Company,* and included in Governor Roosevelt's order.

At the present time 800 hides are tanned daily at the plant. In this operation about 1,600 pounds of lime and 165 pounds of lactic acid are used per day. From the tanks in which these chemicals are used, and in which hides are washed, upward of 300,000 gallons of effluent are discharged daily. Also, some of the tanning solution, made by passing water over ground hemlock bark, is discharged during the final washing of the hides.

The effluent from this tannery, containing hair scraped from the hides, deposited lime, manure, etc., is first discharged into a settling tank where the solid matter settles out and is finally carried away for fertilizer. The clarified effluent is then discharged into the public sewer system of Ballston Spa. This settling tank has been constructed a little more than one year and the clarified effluent has been discharged into the public sewer system of the village for about one year.

It will be seen, from the facts above stated, that the sulphite mill has not only failed to comply with the order of Governor Roosevelt but has increased its capacity during the past few years, thereby increasing the amount of effluent and waste matter which are discharged into the stream.

No plans have been presented to this Department for approval for a sanitary process of treating their effluent, as required by the order.

Since this order was made, the village of Saratoga Springs prepared and submitted to this Department for approval plans for a sewage disposal plant and for a revision of its sewer system; and these plans were approved by the Department and the village has spent approximately $200,000 in complying with the provisions of the order in thus constructing a sewage disposal plant which has been in operation for several years with excellent results.

The village of Ballston Spa prepared and submitted to this Department plans for a sewage disposal plant which it is at present constructing.

It will be seen, therefore, that the order of Governor Roosevelt imposed upon the villages mentioned a large expense and that they complied with the provisions of his order after some delay.

This being the case, I would respectfully urge that this would appear to be a case where extreme measures would be justifiable and an executive order issued directing the immediate discontinuance of the discharge of the effluent and waste material from this sulphite mill into the stream.

I beg to call your attention to the apparent discrepancy in the original proceedings which I have outlined.

You will note that Governor Roosevelt's order, directing the State Board of Health to investigate the matter, required a report to be made to him on or before the 10th of March, 1899.

The report was not made by the State Board of Health until March 22, 1899, some time later than it was required to be made.

The complaint of Mr. Whalen is herewith returned to you and I beg to state that I would be glad to make a further investigation or to submit further evidence to you should you deem it advisable.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

CATSKILL

POLLUTION OF CATSKILL CREEK

ALBANY, N. Y., *October* 1, 1907.

HON. EUGENE H. PORTER, *State Department of Health, Albany, N. Y.:*

DEAR SIR:—Inclosed please find a letter addressed to Governor Hughes by Miss Josephine Hopkins, of Catskill, N. Y., which is referred to you for a report.

Please return Miss Hopkins' letter with your reply.

Very truly yours,

ROBERT H. FULLER,
Secretary to the Governor

CATSKILL, N. Y., *October* 1, 1907.

GOVERNOR CHARLES E. HUGHES, *Albany, N. Y.:*

DEAR SIR:— Although fully sensible of the presumption of intruding on your valuable time, I venture to address you on the subject of the water pollution in my native town, Catskill, N. Y.

Living, as I have done all my life, on the banks of the Catskill creek, half a mile above its entrance into the Hudson river, I have watched its continuous and increasing pollution with deep regret.

Rising twenty-eight miles up in the mountains of Schoharie county, it used to be a beautiful stream of clear water — filled with fish — and so pure that ice for family use was always cut from it.

Leaving out the question of sentiment and accepting the necessary changes connected with a growing population, I wish to call attention to the fact that for thirty years and more factories and sewers have been allowed to pour their contents into this creek, night and day, in utter violation of the laws of the State, as I understand them, so that it has become almost a common sewer. Its surface is covered with floating masses of papers and other rubbish thrown from the mills and docks and its waters are deeply colored with dye-stuff. All these things, combined with the odors of numerous sewers, make life to those on its banks very uncomfortable, to say the least. Up to within a few years, there was excellent fishing (black bass, perch, etc.) through all its course. Now it is all gone.

The protests which have occasionally been made to the authorities are disregarded and there is no effort to compel the millowners to obey the law. Of course in a country town it is difficult to arouse or create public sentiment against nuisance of this kind for several reasons: Indolence, ignorance, politics, and especially, the fear of antagonizing the mill people and so "hurting business" as they would say.

There are two large woolen (knitting) mills, one foundry, one facing mill, one electric light plant, one gas plant and three brickyards (besides other lesser nuisances) all draining into the creek within the space of half a mile.

We have long felt hopeless of any amelioration of these conditions, but when I saw by the newspapers this spring that you were to look into the matter of our polluted waterways, and considering the wonders you have accomplished, and knowing your sense of justice, and your deep interest in the welfare of the people of your State, I have felt emboldened to write and draw your attention to this matter in the hope that in any possible future investigation, our conditions may be considered.

Trusting you will pardon me for the liberty I have taken, I remain with great respect

Very sincerely yours,
MISS JOSEPHINE HOPKINS

ALBANY, N. Y., *October* 25, 1907.

HON. CHARLES E. HUGHES, *Governor of the State of New York, Albany:*

SIR:— I have the honor to submit herewith a report upon an inspection of the sanitary conditions of Catskill creek, with reference to the alleged discharge therein of domestic and industrial sewage.

This inspection was made in accordance with directions contained in a letter from you, dated October 1, 1907, accompanying which was the written complaint of Miss Josephine Hopkins, of Catskill, with regard to the alleged nuisance along the creek.

A careful investigation was made of the sanitary condition of the creek in the vicinity of and above the village of Catskill by our Consulting Engineer on October 14, 1907, which included an examination of the sewer outlets along the banks of the creek as well as the discharge from certain mills referred to by the complainant. The effect of the discharge of sewage from both of these sources upon both the quality of the water and its effects in producing a nuisance were also carefully studied. The results of these observations and studies, with estimates of the amounts of sewage of different character discharged into the stream, and the intensity of pollution resulting therefrom, are given below.

Catskill creek is one of the important streams of New York State, draining as it does one of the most picturesque sections in the eastern part of the State. Owing to the purity of its waters and its geographic location, it is likewise important as one of the proposed additional water supplies of the city of New York. It rises in the heart of the Catskill mountains in Schoharie county in the village of Broome, and flows in a generally southeasterly direction for a distance of about twenty-eight miles to the Hudson river, entering the same opposite the village of Catskill. The drainage area at the mouth of the creek is 394 square miles. The principal tributary is Kaaterskill creek which enters from the south at a point about two miles above the junction of Catskill creek with the Hudson river.

Owing to the precipitous slopes of the tributary watershed, many of which have been denuded of forest growths, Catskill creek is subject to unusual freshets during the rainy seasons. Again, owing to the lack of sandy flood plains which usually furnish a considerable amount of " invisible storage," the summer flow of the stream is unusually low. These maximum and minimum flows will be subject to considerable variation in the future, if the proposed diversion of a portion of this watershed for the future water supply of the city of New York, amounting to some 230 square miles, is carried into effect.

Although the summer flow is a widely variable quantity, the monthly average will be not far from forty cubic feet per second from July to September. At times it will be as low as even twenty-five cubic feet per second. The question of the extent to which these figures may be modified by the diversion of a portion of the watershed by the city of New York, will depend entirely upon the conditions of operation of the proposed storage reservoirs, especially with reference to the amount of water that will be allowed or required to be discharged over the waste weir during periods of low water. Assuming that no water will be allowed to waste over the crest of the dam, the average summer flow may be reduced as low as to twenty cubic feet per second.

The pollution of Catskill creek is derived from two sources. One source is the domestic sewage that is discharged into the creek and its tributaries from the population in villages and hamlets provided with public or private sewer systems. The other source is the manufacturing sewage discharged from the mills and industries, located along the banks of the stream, which discharge the refuse from their industrial operations either into the sewer systems mentioned above, or directly through independent drains into the stream.

It was found during the inspection on October 16th that above the village of Catskill there are practically no villages or hamlets provided with modern sewer systems, and that although no complete canvass was made of the whole watershed, both town and village health officers of Catskill testified that there were few if any hotels or other buildings situated along the creek and its tributaries, which discharge sewage directly into the streams. The fact that a large portion of the watershed was selected by the city of New York for an additional water supply is further evidence of the fact that the waters of this creek are but very slightly polluted — at least so slightly in the opinion of the experts of the New York Water Supply Commission as not to affect the quality of the water for potable purposes.

This testimony with respect to the purity of the upland waters of Catskill creek was corroborated by the appearance of these waters above the point of confluence of Kaaterskill creek, the waters in both tributaries being slightly turbid, but showing no visual indications of sewage pollution. In fact, the sewage discharged into the river which produced any visual traces upon its quality was found to be derived from the village of Catskill, and a careful inspection was, therefore, made of the sanitary conditions along the shores of the creek in the village of Catskill. The section of the creek from a point below the dam east of the junction of Kaaterskill creek is tidal, having a range of tide between two to three feet.

The village is served by a system of sewers, many of which are old, and practically all of which serve for surface drainage as well as sewerage. These sewers all discharge directly into Catskill creek and enter the same at various points along the water front from the railroad bridge almost to its outlet into the Hudson river. It was estimated that the sewage from a population of about 4,000 people in winter, and 8,000 in summer is discharged into the creek from these sewers. There is no method of sewage purification, the disposal being by dilution with the waters of the Catskill creek and the tidal waters of the Hudson river.

Computation of the tidal volume that enters the Catskill creek twice daily to dilute the sewage can only be computed approximately and these computations indicate that in the summer time about 150,000,000 gallons of tidal water from the Hudson river and about 25,000,000 gallons from Catskill creek flow along the shores within the village and aid in the dissemination and dilution of the sewage. Under the condition of multiple discharge system of sewerage, it is estimated that this dilution is at least five times the amount necessary to prevent a nuisance, although at times there may be unusual combinations of tide and stream flow that would lessen this factor of safety.

In regard to manufacturing sewage, specific complaint in respect to which was made by Miss Hopkins, I found that in the village of Catskill there were two mills of considerable size which manufacture knit goods. One of these, the Wiley knitting mill, is located on the north bank of the river just above the steel bridge near the center of the town, and the other, the Malcolm Knitting Company, is located about a half mile below on the southerly shore of the creek. In the manufacturing operations of both these mills, dyes and other chemicals are used, the wasted portions of which are discharged directly into the Catskill creek.

In the Wiley mill, which employs 250 hands, and manufactures 400 dozen garments per day, it was estimated that about 50 pounds of dyes and 200 pounds of salts are used in the dyeing processes. In the Malcolm mill, which employs 150 hands and manufactures about 300 dozen garments per day, it was estimated that about ten pounds of dyes and twenty-five of salt were used. It was further estimated that about 98 per cent. of these chemicals were taken up by the garments during the process of dyeing, so that not more than 2 per cent. of them were discharged into the stream. The total amount of chemicals discharged from both mills amounts to 60 pounds of dyes and 225 pounds of salt per day, and on the basis of 2 per cent. loss, the amounts of these chemicals which reach the creek as wastes are one and one-quarter pounds of dyes and four and one-half pounds of salt.

The effect of discharging this small amount of analine dyes into the waters of the creek, on account of their color intensity, is to discolor the water only in the vicinity of the points of discharge. The discharge of these dye wastes is intermittent, but at the time of the inspection they were being discharged into the stream, but could be only very faintly detected beyond a distance of about 100 feet from the point of discharge. At times of the turn of tides, this coloring matter might be detected at a somewhat greater dis-

HOLLYWOOD

POLLUTION OF RAQUETTE RIVER

ALBANY, N. Y., *August* 17, 1907.

HON. EUGENE H. PORTER, *State Department of Health, Capitol:*

DEAR SIR:— Inclosed please find a complaint addressed to Governor Hughes by L. L. Goodale, President of the Jordan Club, Hollywood, N. Y., which the Governor directs me to refer to you.

Very truly yours,
ROBERT H. FULLER,
Secretary to the Governor

HOLLYWOOD, N. Y., *August* 15, 1907.

Governor HUGHES, *Albany, N. Y.:*

DEAR SIR.— Having read a synopsis of the report recently made to you by Dr. E. H. Porter on commercial pollution of the Upper Hudson, we wish to bring to your notice identical conditions existing along the Raquette river, the second river in the State.

The summer homes of the members of the Jordan Club are situated on this river at Hollywood, about eighteen miles below the first large paper mill on its course — that at Piercefield, belonging to the International Paper Company. We are thus exposed to the damage and annoyance resulting from the pollution of the river by waste from the mill, precisely as described in the report on the Upper Hudson, and, in addition, to further discomfort, owing to the practice of the same mill in completely shutting off the flow of water when not running the mill. This occurs at least once a week, and lowers the water at Hollywood to such an extent that ill-smelling banks are exposed, bathing places are spoiled, and boating becomes dangerous and in some places impossible.

We bring these facts to your attention, trusting that you will consider them grounds for an investigation of the Raquette similar to that of the Upper Hudson, and we respectfully request that such an investigation be made.

Respectfully yours,

L. L. GOODALE,

President

JOHN C. FLOOD,

Secretary

Albany, N. Y., *September* 16, 1907.

E. H. Porter, M.D., *State Commissioner of Health, Albany, N. Y.:*

Dear Sir:—I have the honor to report that, in accordance with your instructions, I visited the sulphite pulp mill of the International Paper Company, at Piercefield, and examined the quality of the water of the Raquette river from that point down stream to Hollywood, a distance of about nineteen miles.

According to the complaint of Mr. L. L. Goodale, president, and Mr. John C. Flood, secretary, officers of the Jordan Club, an association owning land on both sides of the Raquette river at Hollywood, the water adjacent to their property is visibly contaminated by the wastes of the Piercefield mill, and the pulp fibre is deposited on the bottom and banks of the stream. At low water, it is alleged that decomposition of these deposits occurs, causing ill-smelling odors, that bathing places are spoiled, and that the value of the club property as a summer residence is materially diminished.

At the time of my visit, the river was high on account of recent rains and no odor was perceptible, and while the water had a dark or reddish brown color, it was not more discolored than is common and peculiar to Adirondack streams. I must believe, however, from the positive evidence of residents at Hollywood that at certain times objectionable odors are perceptible and, in default any other possible source, since the river from Piercefield flows through a wilderness with no other source of contamination, that the cause of the odors is the deposit of woody fibre and of ligneous and tarry components brought down in solution by the acid waste liquor.

I was informed that at times of low water deposits of slimy, gelatinous matter were conspicuously visible on stones, etc., but that in high water these deposits would be largely washed away. I was not able to discover any such deposits at the time of my visit.

I recommend that if any general action is taken by authority of the State tending to decrease the direct discharge of pulp mill refuse into the waters of the State, that such action include the mill of the International Paper Company, at Piercefield, particularly in reference to the discharge of fibre, and that a personal letter be written at once to the International Paper Company with a view of enlisting their co-operation in the matter of keeping such fibre out of the stream by a series of adequate screens.

Yours respectfully,
HENRY N. OGDEN,
Acting Consulting Engineer

ALBANY, N. Y., *September* 16, 1907.

E. H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I desire to report that in connection with the visit made to Piercefield on account of the complaint made by the president of the Jordan Club at Hollywood, my attention was called to the insanitary conditions existing in the Piercefield water supply. About four miles above Piercefield, the village of Tupper Lake discharges, from its sewer system, sewage into the waters of Raquette pond, a small shallow pond emptying into the Raquette river and so directly contaminating the water supply of Piercefield. It was stated by one of the residents of Piercefield that typhoid fever had been almost continually prevalent in that village and that during last winter the number of deaths was so great as to assume the proportions of an epidemic. The population consists largely of employees of the paper company and is chiefly French Canadian, whose standards of living are not high, so that the mortality from the disease is large.

I recommend that, in communicating with the International Paper Company, at Piercefield, in the matter of their wastes, their attention be called to the pollution of the water supply furnished to their employees, and that they be advised, in the interest of the efficiency and permanence of their workmen, to take up the question of furnishing an upland water supply.

I recommend also that the officials of the village of Tupper Lake be communicated with, with a view of ascertaining whether they have filed a record of their sewer system, whether their plans have been approved and whether under the law it will be possible to modify their method of discharge.

Respectfully submitted,

HENRY N. OGDEN,
Acting Consulting Engineer

ALBANY, N. Y., *September* 20, 1907.

INTERNATIONAL PAPER COMPANY, *Piercefield, N. Y.:*

GENTLEMEN:— One of our engineers recently visited Piercefield and made an examination with reference to the alleged pollution of the Raquette river, complaints regarding which had been received by Governor Hughes and referred to this Department for action.

It appears from his report, which I have before me, that the water of the Raquette river is visibly contaminated by the wastes of your Piercefield mill; that the pulp fibre is deposited on the bottom and banks of the stream and that at low water decomposition of this deposit occurs, causing ill-smelling odors and in other ways affecting the quality of the water for certain purposes.

Our engineer recommends that action be taken with reference to this discharge of fibre from your mill and suggests that you be communicated with at once with a view of securing your co-operation in the matter of keeping such fibre out of the stream by a series of adequate screens. I am, therefore, communicating with you that you may have opportunity to take proper steps along this line before any further action on the part of the Department, and

I would be pleased to have you advise me at once as to what relief on the part of your company the Department may look for.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

ALBANY, N. Y., *September* 20, 1907.

INTERNATIONAL PAPER COMPANY, *Piercefield, N. Y.:*

DEAR SIRS:— I wish to bring to your attention the insanitary conditions existing in the Piercefield water supply. The village of Tupper Lake discharges sewage from its sewer system into Raquette pond, a small shallow pond emptying into the Raquette river and so directly contaminating the water of Piercefield. I have been informed that typhoid fever has been almost continually prevalent in the village and that during last winter the number of deaths was so great as to assume the proportions of an epidemic. As the population consists largely of employees of your company, I wish to call your attention to the pollution of the water supply furnished your employees, and would respectfully advise you that in the interest of the efficiency and security of your workmen the question should be taken up of furnishing an upland water supply.

The matter of the pollution by the village of Tupper Lake will be the subject of further investigation by this Department.

I would be pleased to hear further with reference to this matter at your convenience.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

PIERCEFIELD, N. Y., *September* 21, 1907.

MR. EUGENE H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Your two favors of September 20th are at hand and contents carefully noted, and I have referred them both to our New York office.

I will, however, say that this company is taking immediate steps to supply the village with suitable drinking water.

In relation to the pollution of the Raquette river; we do as little as possible of this with the conveniences at hand, but we are also taking steps to save a large proportion of this fibre which now runs into the river, and which causes a great deal of loss.

You can assure the Governor that we shall do everything possible to bring this matter to a minimum.

Yours very truly,
INTERNATIONAL PAPER CO.,
EUGENE I. DANIELL,
Superintendent

NEW YORK, *September* 26, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Your two favors of September 20th addressed to our mill at Piercefield have been forwarded to us.

In one you take up the matter of the supply of water to our employees. You will perhaps remember that it was at our initiative that your Department made a careful examination of the condition at that mill relating to the supply of drinking water. Since receiving your report we have been trying to find a suitable source of supply of drinking water and now have under consideration the building of a small reservoir on one of the streams in the neighborhood, and if it is concluded this will provide an adequate supply the work will be undertaken immediately. As I understand it, the use of the river water even if steps were taken to prevent pollution and even if the water was filtered would not be wholly without objection.

We are very anxious to correct the condition and assure you that we will do so as early as possible.

In regard to the matter of mill waste referred to in your other letter, as our superintendent has written you we have every incentive to minimize the discharge of fibre into the river, and while we do not admit or believe that there is any discharge of waste material that is detrimental to health or in any way constitutes a public nuisance we intend as stated to minimize such discharge.

We have spent a great deal of money in experimenting and assure you that the problem presents almost insuperable difficulties.

Yours very truly,

CHESTER W. LYMAN,

Manager

HORNELL

ALBANY, N. Y., *July* 9, 1907.

HON. EUGENE H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Inclosed please find a letter from Mr. Leon L. Hough, of Canisteo, N. Y., inclosing charges of the pollution of the Canisteo river. I am directed to refer the matter to your Department for suitable action.

Very truly yours,

ROBERT H. FULLER,

Secretary to the Governor

ALBANY, N. Y., *August* 10, 1907.

HON. RICHARD M. PRANGEN, *Mayor, Hornell, N. Y.:*

DEAR SIR:— I inclose herewith a report made to me by our engineer on the conditions existing in the Canisteo river below Hornell, due, as he believes, to the discharge into the river of the domestic sewage of Hornell and to certain trade wastes from factories.

I desire to call your attention to the recommendations of his report, and to point out to you that, under the conditions, the discharge of the Hornell sewage into the river is illegal through no report having been filed, and that the city is liable to the penalty prescribed for such offenses, viz., $500, and a penalty of $50 per day for each day the discharge is continued.

I believe that under the circumstances the city should at once notify the Merrill Silk Company and the Prindle Tannery that their wastes must be purified before being discharged into the city sewers, or else lose the privilege of such connection.

The matter of the discharge of the Huguet Silk Company and the Kayser Silk Company, I have taken up with these companies individually.

I also wish to call your attention to the recommendation that no connections be allowed or that all connections heretofore made be discontinued with the stone drains since such a use of these drains is illegal and makes the city liable for the penalty above mentioned for each of such drains.

I further advise you that this Department will require from you within one year plans for a sedimentation tank for the city sewers by which the solid organic wastes may be retained.

Trusting that you may be able to take up this matter at once, I am

Yours respectfully,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *August* 7, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health*,
Albany, N. Y.:

DEAR SIR:— In accordance with your instructions and on account of a communication from the Executive Chamber of the State of New York, referring to you a certain complaint of Mr. L. L. Hough, of Canisteo, N. Y., I visited the city of Hornell and the village of Canisteo on July 23d and inspected the conditions complained of.

The complaint referred to alleges that the silk mills of Hornell discharge dyestuffs into the river, causing the water to become inky black and the poison of the dye killing the fish in large numbers.

I find that the city of Hornell, situated on the Canisteo river in the county of Steuben, has a population of 13,259 by the State census of 1905. The village of Canisteo is on the same river and about five miles down stream.

The matter is not new and has been, it is stated by the complainant, referred to the Forest, Fish and Game Commission without action on their part up to the present. The matter has also been before this Department, hearings having been held by O. H. Landreth for the Commissioner in the fall of 1905, no report, however, having been made by him of his findings in the matter.

The river rises in the town of Birdsall in the northeastern corner of Allegany county, and flows easterly about ten miles to the village of Arkport, thence southeasterly to Hornell, a total distance of fifteen miles. The country drained is very hilly, the tributaries being torrential and the average slope of the river from Arkport to Hornell is ten feet per mile while from Hornell to Canisteo is but two feet per mile.

The principal tributary is the Caneadea creek which empties within the city of Hornell. Bennett creek at Canisteo, Big creek, Honey run, Crosby creek and Purdy creek are other tributaries. The watershed area just above the village of Canisteo, not including Bennett creek, is about 210 miles according to Rafter; 171 miles according to Whipple; and no gaugings are accessible as to the stream flow. The maximum or flood flows of such a stream are large, probably 40 cubic feet per second per square mile and the minimum flow is probably 0.1 cubic feet per second per square mile for protracted periods of the summer months. Judging by gaugings made on the neighboring watershed of the Genesee, there are probably days when the flow is only half the amount or .05 cubic feet per second per square mile. It is probable, therefore, that the maximum flow is about 8,000 cubic feet per second with occasional floods of 16,000 cubic feet per second and that the minimum summer flow is twenty cubic feet per second and that this occasionally decreases to ten cubic feet per second for several days.

The character of the stream between Hornell and Canisteo is that of an alluvial stream, very tortuous, winding through a valley of from 1,000 to 4,000 feet in width, the stream itself being generally shallow with occasional pools between riffles, the water surface being about fifty feet in width. The ordinary channel, on account of the diminished slope between Hornell and Canisteo and on account of the tortuous direction of the stream, is not large enough for the flood flows which more than fill the banks, escaping onto the bottom lands and depositing more or less sediment thereon.

The chief complaint, on account of which the hearings of 1905 were held, was that garbage from the city's dump was picked up by these floods (claimed to occur three to five times a year) and deposited generally above and in certain parts of the village of Canisteo. At present, however, the dumping ground is carefully looked after, the garbage being burned or buried so that this source of complaint no longer exists.

The present complaint, therefore, is not on account of the flooding but on account of the character of the water in the stream alleged to be fouled by the sewage of Hornell and particularly by the manufacturing wastes discharged therein. Under date of November 27, 1891, Mr. Carroll Phillips Bassett, engineer of Newark, N. J., submitted to the sewer commissioners of the city of Hornell plans and profiles of a complete sewer system and the construction of the system was commenced in 1892. On account of difficulties met in the construction, the city was in litigation with the contractors for a period of about four years. The original contractors being forced into bankruptcy and the sewer line itself being imperfectly constructed the bondsmen were obliged to expend large sums of money on repairs. It was, therefore, not until 1896 that the sewers were formally accepted by the city and house connections authorized.

Owing to the faulty construction, there is a large amount of ground water flowing in the sewers, making the sewage very dilute. The population tributary to the sewers is estimated at about 6,000, although it is probable that with a population of 13,259 this number will continually increase.

There are in the city several manufacturing plants which discharge wastes into the river, viz., the Merrill Silk Company, corner Grand and Pleasant streets; the Huguet Silk Company, near the corner of Thacher and Steuben streets; the Steuben Silk Mill Company, at the head of Main street; and the Prindle Tannery, corner of Canisteo and Spruce streets. Of these, the

Steuben mill does no dyeing, the Merrill Company and the Prindle Tannery being the factories which contribute pollution to the river. Of these, the Merrill Company discharges into the main city sewers, the Huguet mill has a private line to the river just outside the city limits, and the tannery discharges into a separate line of sewers emptying into the river at the foot of Delaware avenue.

The effect of the above discharge on the river is very evident, the color of the sewage being black or dark purple at times, changing to a lighter color at certain times of the day and then to the dark color again. The water is turbid, carrying through the day about ten times as much material as at night. There was a very perceptible odor to the stream, suggesting sewage contamination. Assuming a minimum flow of twenty cubic feet per second as indicated above, the stream should be able to assimilate without the production of any nuisance sewage at the rate of five cubic feet per second for each 1,000 population contributing — or a total population of 4,000 persons. If the actual population is 6,000, with the probability of the number gradually increasing to 9,000 or 10,000, the nuisance now existing in the stream is readily accounted for. And if to the domestic sewage is added the dyestuffs and tannery wastes, the ground for the complaint is evidently well taken.

The plans for the sewer system of Hornell do not appear to have been approved by this Department and the city has not yet filed plans as required under the law of 1903.

I recommend, therefore,

1. That an order be issued requiring the city of Hornell to discontinue the connections of the Merrill Silk Company and of the Prindle Tannery, unless the wastes of those mills be first purified and that the latter be ordered to discontinue the discharge of any wastes directly into the river.

2. That the Huguet Silk Company be required to construct a sedimentation tank on the line of their private sewer.

3. That the Kayser Silk Company be required to remove their private sewer from the river and connect with the city sewer or provide proper purification.

4. That the city disconnect all house connections now made with the stone drains.

5. That the city submit plans within one year for a sedimentation tank by which the solid wastes may be removed from the stream.

Respectfully submitted,

H. N. OGDEN,

Assistant Sanitary Engineer

HORNELL, N. Y., *August* 14, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Your communication of the 10th, together with the recommendations of your Mr. Ogden, with regard to the sewerage system of the city of Hornell, have been duly received by me, and the board of health and board of public works have taken immediate action on same, that we may correct any unhealthy conditions existing in our community.

Very truly yours,

R. M. PRANGEN,

Mayor

ALBANY, N. Y., *August* 10, 1907.

HUGUET SILK CO., *Hornell, N. Y.:*

DEAR SIRS:— I desire to call your attention to the provisions of section 77 of the Public Health Law by which any shop, factory, mill or industrial establishment is prohibited from discharging refuse or waste matter into the waters of the State or from discharging sewage or any decomposable or putrescible matter into the waters of the State without a permit from the Commissioner of Health, and to section 79d by which the penalty for such discharge is fixed at $100, with a further penalty of $10 per day for each day the offense is maintained.

I inclose blank application form for the permit but advise you that the permit will be granted only with the express condition that your company construct a sedimentation tank of proper size whereby the solid wastes may be retained before discharge into the river.

Respectfully yours,
EUGENE H. PORTER,
Commissioner of Health

HORNELL, N. Y., *August* 14, 1907.

The State Department of Health, Albany, N. Y.:

GENTLEMEN:—We are in receipt of your letter of August 10th, also blank application form for permit for discharging sewerage into the waters in the Canisteo river, which we filled and are returning you inclosed.

We have taken up the matter of the sedimentation tank with the town board of health, and will have it constructed with the shortest delay possible according to their instructions.

Hoping that this will be satisfactory, we remain,

Yours very truly,
HUGUET SILK COMPANY,
E. J. GUTTINGER,
Superintendent

ALBANY, N. Y., *August* 10, 1907.

KAYSER SILK CO., *Hornell, N. Y.:*

DEAR SIRS:— I desire to call your attention to section 75 of the Public Health Law, which prohibits the discharge of any sewage or any decomposable or putrescible matter of any kind into the waters of the State without the express permission of the Commissioner of Health, and to section 79d by which the penalty for such discharge is fixed at $100, with a further penalty of $10 per day for each day the offense is maintained.

I inclose blank form of application but have to advise you that the permit will be granted only with the express condition that your company construct a sedimentation tank of proper size on the line of your sewer whereby the solid organic wastes may be retained before the discharge takes place. Should you be able to connect with the city sewer system, no permit will be required.

Respectfully yours,

EUGENE H. PORTER,

Commissioner of Health

HORNELL, N. Y., *September* 9, 1907.

EUGENE H. PORTER, M. D., *Albany, N. Y.:*

DEAR SIR:— We have yours of August 10th in regard to our sewer. The reason that we have delayed so long in answering is that we have been shut down for about three weeks and everything was dropped for the time. In answer to yours will say that we will give the matter immediate attention and find out which is our best way, to connect with the city sewer or build a catch basin in our sewer and continue using it. If we conclude to build a catch basin, we will fill out the application and forward to the State Department of Health.

Yours truly,

JULIUS KAYSER & CO.

ALBANY, N. Y., *September* 21, 1907.

Hon. RICHARD M. PRANGEN, *Mayor of Hornell, Hornell, N. Y.:*

DEAR SIR:— Some time ago I received a communication from Mr. Parsons, the city attorney, in which he stated that at your request he was communicating with me.

He advised me that upon receipt of the recommendations of this Department with reference to the disposal of the sewage of the city of Hornell the board of health took immediate action compelling the discontinuance of the use of storm sewers for sanitary sewers and the board of public works have taken the subject of the purification of the trade wastes up with the factories and the recommendations of the Department would be carried out at the earliest possible time.

I am recently in receipt of further complaints regarding the conditions there and would like very much to know what progress has been made. Unless some steps have been taken by the mills which are discharging their wastes into the Canisteo river, which will lead to immediate discontinuance of this practice, I feel that under the circumstances the Department will be forced to bring immediate action against them. Will you, therefore, kindly advise me what steps have been taken by these various mills and whether any plans have been prepared or any work begun which will result in taking these wastes out of the stream.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

HORNELL, N. Y., *September* 24, 1907.

EUGENE H. PORTER, M.D., *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Your communication of September 21st is duly received, and I beg to advise you that we are carrying out the recommendations of your Department in the most practical manner and with as little delay as possible considering the conditions.

I beg further to state that of the recommendations by your Mr. Ogden:

First, with regard to the Merrill Silk Company plant. This plant was closed down from about the 15th of August to September 5th, and it was impossible for the Merrill people to get such samples of the discharge from their dyehouse as was necessary to be analyzed until after they had started up on September 5th. They immediately had samples of this sewage from their dye plant sent to Pittsburg and Buffalo, and are expecting every day to be able to establish a purification system in connection with their plant, which will purify the sewage from their dye plant and will be satisfactory to your Department.

The Prindle Tannery has closed down and gone out of business, therefore there is no waste from this plant emptying into the Canisteo river. The few sanitary sewer connections, which seem to have been made some years ago with the storm sewers, are now being cut out and connections being made with the sanitary sewer.

The other recommendation by your Mr. Ogden, that the city of Hornell shall submit plans within one year for a sedimentation tank, by which the solid wastes may be removed from the stream, will have the attention of our superintendent of public works in due time.

I beg further to state that the Merrill Silk Company expect to have their reports from Pittsburg and Buffalo not later than October 2d, and we would request, if you can so arrange, that you will send your Mr. Ogden here to go over this matter again with them, that when they have completed their purification system it will receive the approval of your Department.

Awaiting your further instructions, I am,

Most respectfully,

R. M. PRANGEN,

Mayor

ALBANY, N. Y., *December* 10, 1907.

MRS. JANE A. MACDOUGALL, 34 *Center street, Hornell, N. Y.:*

DEAR MADAM:— I desire to call your attention to the provision of section 77 of the Public Health Law, by which the discharge of any sewage or any decomposable matter of any kind into the waters of the State without the express permission of the Commissioner of Health is prohibited. Also to section 79d by which the penalty for such discharge is fixed at $100, with a further penalty of $10 per day for each day the offense is maintained.

I am advised by our inspector, who has recently visited Hornell, that the so-called MacDougall sewer continuously discharges raw sewage into the Canisteo river, and that the owners of the sewer are, therefore, guilty of a violation of the law just referred to, and are liable for the penalty prescribed.

I am taking up the matter of the treatment of the sewage of

Hornell with the mayor and other officials of the city, and advise you that hereafter private conections will not be allowed independently of the city system.

You are hereby required, therefore, to comply with the provisions of the law and discontinue the use of this sewer for house sewage, and in particular to disconnect all houses now connected and discharging in defiance of the law.

I shall regret the necessity of being obliged to take further action in this matter, but, unless it receives your prompt attention, I shall feel it my duty to proceed.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

On November 30th a conference was held between Special Assistant Engineer Ogden of this Department and Mayor Prangen, City Attorney Parsons and City Engineer Leach representing the city of Hornell and Mr. Merrill of the Merrill Silk Company.

Earnest efforts are evidently being made by the city authorities and the manufacturers to remove the pollution from the Canisteo river.

HUDSON RIVER

POLLUTION OF ICE FIELDS

Reports on the Pollution and Self-Purification of Ice

ALBANY, N. Y., *February* 20, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— In response to your request, I beg to submit herewith a statement of the information which I have regarding the transmission of disease by infected ice. This information I have summarized in the form of a set of notes which represents, as far as I know, the best information available upon this question.

The authorities are quoted in each case and supplementing these notes are my conclusions and recommendations with respect to what action, if any, should be taken in the future to conserve the ice supplies of this State.

I. PRINCIPAL SOURCES OF ICE INFECTION

1. Polluted rivers and other polluted bodies of water from which ice is taken.
2. Exposure of ice to contamination during harvesting.
3. Exposure of ice to contamination during distribution.
   - (*a*) Exposure to polluted air.
   - (*b*) Handling and housing of ice by icemen.
   - (*c*) Depositing ice in streets or on sidewalks.
   - (*d*) Insufficient rinsing of ice, together with handling, just prior to placing in ice coolers.

II. INFLUENCES ACTIVE IN THE PURIFICATION OF NATURAL ICE HARVESTED FROM POLLUTED SOURCES

1. The effect of subsidence and oxidation upon suspended matters and bacteria in bodies of flowing water is in general to remove from 50 per cent. to 100 per cent. in a run of from ten to fifty miles. With bodies of quiet water this removal is much greater.

See Report Massachusetts State Board of Health, 1890; Report U. S. Geological Survey, W. S. & I. paper 185; Boston Society of Arts, vol. XV, No. 2 (fifteen authorities quoted).

2. The effect of freezing produces a phenomenon equivalent to filtration by which there is eliminated a large proportion of the suspended matter, chemical constituents and bacteria as follows: Of the chemical compounds about 25 per cent. are eliminated, ranging from 7 per cent. to 40 per cent. according to the constituent. Of the bacteria about 90 per cent. are eliminated according to different conditions.

See Report Massachusetts State Board of Health, 1889 & 1900; Memoirs Academy Arts & Sciences, vol. 12, No. 5, 1902 (containing bibliography on the subject and citing some forty-seven authorities).

3. The effect of time interval between season of harvesting and season of distribution of ice to consumers results in death

of bacteria according to Whipple, Jordan, Fuller, Sedgwick and others to be more than 99 per cent. in from thirty to sixty days.

See Report of Commission of Additional Water Supply of New York City, 1904; Report Massachusetts State Board of Health, 1892; paper by G. C. Whipple in Report of Annual Conference of Sanitary Officers, 1905.

4. Effect of freezing temperature (not "freezing filtration") is to destroy bacterial life, and especially pathogenic bacteria accustomed to body temperature, in proportion to the time of exposure. In general this destruction is about 50 per cent. in one hour, 90 per cent. in twenty-four hours and 99 per cent. or more in fourteen days.

See Report Massachusetts State Board of Health, 1890 and 1900; Sedgwick and Winslow in Memoirs of American Academy of Arts and Sciences, vol. 12, No. 5.

A numerical illustration of the effect of the four purifying influences just cited may be had by assuming a river polluted to the extent of one-third to one-half of its volume of sewage and that ice is harvested within ten miles of the source of pollution. Crude sewage will average 2,000,000 to 3,000,000 bacteria per c.c.

If then we state say 1,000,000 bacteria per c.c. (i. e., water composed of one-third to one-half sewage) and using the lower percentages cited above, for conservativeness, we have at 50 per cent. removal, according to (1) a residual of 500,000 bacteria per c.c.; at 90 per cent. removal, according to (2) a residual of 50,000 bacteria per c.c.; at 99 per cent. removal, according to (3) a residual of 500 bacteria per c.c.; at 99 per cent. removal, according to (4) a residual of 5 bacteria per c.c.

In other words, within two months we would expect to find five bacteria per c.c. of the 1,000,000 bacteria assumed to be originally present in the ice.

For a comparison we may state that the best slow sand filters, operating under favorable conditions, remove not more than 99 per cent. of the bacteria contained in the raw water. Such a percentage of removal, if applied to the 1,000,000 bacteria assumed above, will give a residual of 1,000 bacteria as against five bacteria found in the ice.

III. INFECTION FROM ARTIFICIAL ICE

Owing to the "filtration effect of freezing" the process of manufacturing ice results in an unequal distribution of suspended matter, chemicals and bacteria are concentrated into the central core of the ice cake, and any one using this central core will receive a stronger dose of infection that may be present.

Again, owing to the fact that artificial ice is generally used very soon after manufacture, the germicidal effect of time and freezing does not exert as great an influence as it does with natural ice. Therefore, infection from artificial ice, unless manufactured from absolutely pure water, may be many times greater than from natural ice.

See American Academy of Science, Memoirs, vol. 12, No. 5; Report Massachusetts State Board of Health, 1900.

IV. QUESTION OF INVESTIGATION AND SUPERVISION OF ICE SUPPLIES

In regard to the question of whether steps should be taken to determine the quality of certain ice supplies already harvested this winter and to prevent the sale of any food to be contaminated and whether the framing of rules and regulations for the protection of ice supplies supplemented by systematic inspection would be practicable, and, if so, whether it would be wise to inaugurate them, I beg to say:

1. That whereas ice taken from polluted sources becomes purified to a comparatively high degree by the natural process of freezing and the continued exposure of contained bacteria to freezing temperature, there is a definite proportion of the original bacteria that remains in the ice in general proportion to the degree of the original pollution.
2. That without an inspection and investigation we have no conclusive proof that ice is not collected from fields located in too close proximity to sewer outfalls nor that, in exceptional cases, the ice is not seriously or even dangerously contaminated.
3. That with care in selecting the ice fields the polluted sections of rivers, such as in the vicinity of sewer outfalls, could be easily avoided and the original pollution be reduced to a minimum, if not practically eliminated.

4. That a code of rules, involving perhaps the issuing of permits which would allow cutting of ice only within certain limits along our rivers, supplemented by an inspection, either directly through inspectors appointed for the purpose during the ice season, or indirectly through the officers of local boards of health, and further supplemented by executive authority to prosecute violations of such rules, I consider to be perfectly practicable.

In view of the foregoing, then, I beg to conclude that, whereas the removal of bacteria from ice taken from polluted sources is by natural processes almost complete and the danger of transmission of disease from ice infection very small, there is at the same time a small margin of danger of infection from ice. There is also an æsthetic objection to organic and other filth associated with polluted waters. On the whole it would seem desirable to have such rules as described above framed for the protection of our ice crops against these dangers and filth, and I consequently recommend that such rules and regulations be prepared and put in force, providing funds for adequate inspection of violations of such rules be appropriated and providing full authority be granted for the prosecution of any such violations.

Very respectfully,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *February* 18, 1907.

DR. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— In response to your request for information concerning the effect of freezing on typhoid bacilli and concerning the transmission of this disease by means of ice obtained from polluted water, I desire to make the following statements and references:

EFFECT OF FREEZING UPON TYPHOID BACILLI

In 1887, Dr. T. Mitchell Prudden, professor of pathology and bacteriology at the College of Physicians and Surgeons of New

York, carried on a series of experiments in connection with the ice supply of the city of New York. By the methods of testing which he used, namely to freeze small amounts of water containing typhoid bacilli, he found that the latter in fair numbers were still alive after 103 days, although about 90 per cent. had been killed off by a few days' freezing.

This work was quoted extensively and was taken as final by many.

Dr. Prudden also made an exhaustive study of the quality of the ice taken from the Hudson river at various points from Troy to Poughkeepsie. He showed that in general the clear transparent ice from these locations contained relatively but few bacteria at most points south of Castleton and that even between Castleton and Albany the number of bacteria numbers are not relatively excessive.

He bases his argument of the danger from this ice, not upon the actual findings of sewage bacteria in it which at that time (1887) was a difficult matter, but upon the results of his tests of freezing typhoid bacilli in small amounts of water in test tubes.

The most important of his practical conclusions, therefore, hinge upon these few tests, and if these results have not stood the test of subsequent work his conclusions, fair and impartial as they were and on the whole not severely condemnatory of Hudson river ice, must likewise be subject to revision.

Thus Dr. W. H. Park, Director of the Research Laboratory of the New York City Health Department, repeated Dr. Prudden's work and obtained results showing that while the same proportions of typhoid bacilli were killed in the first few days of freezing, as Dr. Prudden had found, the rate of decrease thereafter which he observed was much greater than that which Dr. Prudden obtained. At the end of three weeks less than 1 per cent. of those in the water when first frozen remained. Both Prudden and Park showed that repeated freezing and thawing had a far greater killing effect on the typhoid bacilli and but very few remained alive after a few days of such treatment.

Zeit repeated Prudden's experiment imitating his methods and conditions and found that the typhoid bacilli were completely killed by freezing in twenty-four hours.

Clark and Gage, of the Laboratory of the Massachusetts State Board of Health, experimented with larger volumes of water and sewage in tanks and also examined ice taken from the Merrimac river and from other polluted sources.

They found in the tank experiments that from 95 to 99 per cent. of all the bacteria in the water, whether it was relatively pure or was virtually sewage, were removed by the freezing.

Their examinations of Merrimac river ice gave such valuable results that I will quote from Clark's article on the subject. I might say, however, that the Merrimac river is grossly polluted. It is considered by those familiar with water purification problems that the Hudson river at Albany is far less polluted than is the Merrimac at Lawrence where these experiments and tests were made.

" In these first experiments we used a polluted river water and also sewage, and found, as was expected, that, while when freezing all the water a very large proportion of the bacteria in the water frozen were killed in the process of freezing, still a very large number were left in the ice and lived for a number of weeks. Other experiments made in that winter showed what is, of course, well known that, when ice is formed naturally — that is, in the usual manner on the surface of a considerable body of water — most of the bacteria are expelled from the water frozen and remain in the water below the ice, and but a comparatively small number are retained in the ice. For instance, two of the experiments that were made were as follows:

" Merrimac river water, containing 7,100 bacteria per cubic centimeter and 17 B. coli per cubic centimeter, was frozen and the ice formed contained about 5 per cent. of the total number of bacteria in this water, and no colonies of the colon bacillus could be found. Sewage containing 500,000 bacteria per cubic centimeter and 4,100 B. coli per cubic centimeter was likewise frozen, and the ice formed from this sewage contained about 1 per cent. of the bacteria of the sewage, but no colonies of the colon bacillus could be found. In these experiments the liquids were frozen in tanks containing only a slight depth of water below the ice formed.

" During the winter of 1900–1901 the investigation was continued and very many experiments were made, in which volumes of water of varying degrees of purity were exposed in tanks six feet deep and twenty-eight inches in diameter, and the ice formed upon these tanks carefully examined. In all of this experimental work it was found that from 95 to 99 per cent. of the total number of bacteria in the waters experimented with were eliminated from the water during freezing or killed before the examination of the sample, and that, whenever a water not more polluted than the Merrimac river water at Lawrence, into which, however, the unpurified sewage of a number of cities flows, was frozen in these tanks, every colon bacillus was, judging from our examinations, killed or excluded from the ice formed.

"Besides these experiments in the tanks, a number of samples of ice for chemical and bacterial examinations were taken as it formed upon running water such as the polluted Merrimac river, and from still water, also polluted to a greater or less extent; samples of water being collected also, wherever samples of ice were collected. Twice during the winter a series of samples of ice and water was collected from the river at different points above Lawrence and between Lawrence and Lowell, and examined both chemically and bacterially; these samples being collected at distances varying from three to eight and one-half miles below the outlets of the sewers of Lowell — Lowell being a city of 90,000 inhabitants and emptying all of its sewage into this river. Examination of all of these ice samples showed that, while the average number of bacteria in the river water, collected at the same locations from which our ice samples were taken, was 4,100 per cubic centimeter, the average number of bacteria in the ice was nine per cubic centimeter, showing an elimination of 99.78 per cent. The average number of B. coli in the river water was 120 per cubic centimeter, and this germ was not found in any of the ice samples examined. That is to say, the number of bacteria found in the ice formed upon the river was less than the number in the ice formed from the same river water in our experimental tanks. The river ice, however, had been formed for a number of weeks before collection and examination, while the tank ice was examined within a few hours of forming. This probably accounts for whatever difference there was in number of bacteria found, as the river ice had probably been formed long enough for many bacteria, at first retained in it, to die.'

"On the whole, it is evident that the conditions surrounding water when it freezes are very important factors in determining the purity of the ice formed; but it must be said that, as far as we can find, there is only one known case on record where it is apparently absolutely assured that sickness was caused by polluted ice. A large proportion of the inhabitants of the city of Lawrence are supplied with ice harvested from the very polluted Merrimac river water and yet, since the construction of the sand filter by the city several years ago and the filtration of its public water supply, the typhoid fever rate has been made one of the lowest in the State of Massachusetts; and it must also be said that in former years, before the construction of this filter, when epidemics of typhoid fever were common in Lawrence, these epidemics almost invariably occurred in the winter months, rather than in the summer months, when the consumption of ice is the greatest."

Dr. B. H. Stone, of the Vermont State Laboratory, has also shown that typhoid bacilli are killed by freezing for twelve days and that the large majority of them are killed during the first twenty-four or thirty-six hours of freezing.

These experiments were repeated by Dr. J. M. Wheeler in Dr. Stone's laboratory and similar results obtained. He also tested ice obtained from Lake Champlain at distances from the outlets of the city of Burlington's sewers varying from thirty feet to several hundred feet. Although he found plenty of sewage bacteria in the water under the ice *none were found in any of the samples of ice* although "fecal matter was present in both the ice and the water under the ice."

Dr. Wheeler's conclusions on the effect of freezing in the purification of water are as follows:

1. "In the process of freezing there is a great reduction of typhoid bacilli in water."
2. "Typhoid bacilli do not live long in ice."
3. "Ice harvested from ponds and lakes even if subject to sewage contamination, probably is not a source of danger as a means of producing typhoid infection."

From these articles the conclusion could most readily be drawn that the chemical examination of samples of ice would be of no value whatever and all reports of sanitary examinations of ice which have not consisted largely of bacteriological examinations or at the very least have not included thorough bacteriological tests should be discredited. Those in charge of such examinations must be entirely ignorant of the true scientific status of the matter to conduct examinations in that manner.

There exists one reported instance in which not only was typhoid fever apparently transmitted to well persons by the means of ice but in which those making the report believe that they isolated typhoid bacilli from the ice in question.

Drs. R. H. Hutchings and A. W. Wheeler of the St. Lawrence State Hospital at Ogdensburgh reported the occurrence of thirty-nine cases of typhoid fever in that institution under conditions which led them to state that the disease was due to the use of ice taken from the St. Lawrence river.

They examined clear ice taken from the river and found in one culture out of the series made from the ice a bacillus which they considered the typhoid bacillus.

There are several features of this report which merit consideration before conclusions should be based upon it as to the danger of ice as a medium for the transmission of typhoid fever. It has been shown by practically all the experiments quoted above that the elimination of dirt, solid particles, bacteria, etc., from water undergoing the freezing process takes place most readily and certainly when the water is not in motion.

Moreover the authors state that ice had been cut from the same location for the preceding twelve years but the disease had not appeared before under conditions which would lead them to suspect the ice as the source of infection. Moreover the ice from only one out of several icehouses was suspected and examined. All this would seem to indicate that the water which formed the particular ice which they examined must have been most grossly polluted with typhoid discharges in an unusual manner just at the time of its formation. I believe, therefore, that we are warranted in assuming that the outbreak of typhoid fever which they report was the result of a combination of unusual conditions which is not likely to be duplicated in the future, certainly not at all frequently, nothing like this combination of conditions having ever been reported either before its occurrence or since that time.

While the above abstracts are not all that could be quoted, further repetition hardly seems necessary. Enough evidence has been brought forth by laboratory workers to show in my opinion that Dr. Prudden's conclusions as to the danger of Hudson river ice were based on laboratory tests of the effect of freezing on typhoid bacilli not only too few in number but under far too limited variations in conditions.

It should be pointed out that the commercial instincts of ice cutters generally greatly favor the cutting and storing of ice which has been formed under the most favorable conditions for its purification.

The best ice from the commercial standpoint is that formed in clear still water and which is free from surface snow. In fact they go to considerable expense to remove the latter.

As has been stated all experiments go to show that the purer natural ice is free from snow, dirt and air bubbles.

Fortunately, therefore, commercial ends favor the distribution of the better grades of ice from a sanitary viewpoint.

TRANSMISSION OF TYPHOID FEVER BY MEANS OF ICE

Prof. W. J. Sedgwick in his well-known treatise on Sanitary Science (edition 1905, page 258) after speaking of the presence of disease-producing bacteria in snow and ice gives an excellent summary of the practical situation. He bases the first two sentences in the following quotation on the presence of sewage bacteria in snow and snow ice and not exclusively upon clear ice:

" § 5. Ice as a vehicle of disease.— It is plain from what has been said in the last paragraph that ice may contain living pathogenic germs. It may therefore unquestionably be an important vehicle of disease. On the other hand, the literature of the subject fails to reveal any very clear evidence that it has been hitherto a vehicle of any great importance, while it is an indubitable fact that certain cities which have used ice cut from sources known to be infected with the germs of typhoid fever have not suffered perceptibly from the cause. According to

Prudden, the ice supply of New York city was, in 1888, largely derived from the Hudson river — a stream highly polluted by the sewage of Albany, Troy and other places in which much typhoid fever existed. Yet a study of the vital statistics of New York city does not support the idea that much typhoid fever is conveyed by ice, because while ice is almost universally used in that city, its death-rate from typhoid fever has always been and now is exceptionally low for an American city. Boston, on the other hand, while having (as New York also has) an excellent water supply, is supplied with ice of great purity; and yet the death-rate from typhoid fever in Boston is considerably higher than in New York. Again, the cities of Lowell and Lawrence have long been supplied chiefly with ice cut from the polluted and infected Merrimac (cf. pp. 207–212). Formerly, owing to polluted water supplies, both suffered severely from typhoid fever, though not, as might have been expected if ice were the cause, in July and August when ice is most used, but generally much later. With the introduction of purer water, the ice supply remaining the same, typhoid fever in both cities has fallen to the level of typhoid fever in other cities in Massachusetts having ice supplies of unquestioned purity.

"It was from the consideration of facts like these that the author was led to undertake the investigation which is detailed in the paper by himself and Mr. Winslow, and to conclude that in actual everyday life ice as a vehicle of disease is probably less important than might be supposed if one had in view only the fact that pathogenic germs may live for a long time in ice. There appear to be, fortunately, numerous 'mitigating circumstances,' numerous conditions, which serve to decrease the dangers of ice as a vehicle of disease. And if all the facts are known and kept in mind, the various contradictory phenomena, which at first seem hard to harmonize, may be satisfactorily explained.

"Briefly stated, the more important facts appear to be the following: (1) While it is true that some individual bacteria survive exposure to freezing and even very low temperatures, such conditions are highly unfavorable to bacteria in general, even of the same kind, especially if the exposure be prolonged. Water does certainly tend to purify itself, and under ordinary and favorable circumstances does actually and extensively purify itself, during freezing. On the other hand, such purification, while great, is usually incomplete. (2) Out of a number of individual bacteria of any kind subjected to freezing a large proportion usually perish, especially if they continue to be exposed to the low temperature for two or three weeks, but a small proportion survive. (3) There is good reason to believe that the efficiency of the survivors and their virulence is weakened both by their loss of numbers, and by freezing or by long exposure to low temperatures."

Again, Dr. Hibbert Hill, reporting upon his investigation of the ice supply of the city of Boston in 1901, states that the purification of polluted water which takes place during the process of freezing and for three weeks thereafter is equivalent to the filtration of that water by the most efficient slow sand filters. He also concludes that "on theoretical grounds the danger of infection through ice is very small." Practically, and under the conditions of the present Boston ice supply, danger of infection is almost nil.

In view of the above array of facts in the matter, any examination of the ice supplies cut from the rivers of this State would give results of but little if any sanitary value and as our laboratory staff has now at hand more work of the most importance and of infinitely greater sanitary value to the people of the State it would appear inadvisable to divert our efforts which are already far too much restricted by lack of adequate appropriations to work giving so little hope of practical benefit.

Prudden, Medical Record 1887, vol. 31, p. 341; Park, Journal Boston Society of Medical Sciences, 1901; Zeit, Journal of Infectious Diseases, 1904, vol. 1, p. 660; Clerk, Public Health, 1901, vol. 27, p. 205; Hill, Boston Medical and Surgical Journal, 1901, vol. 145, p. 557; Wheeler, Journal of Medical Research, 1906, vol. 10, p. 269; Sedgwick, "Sanitary Science," 1905.

Yours very respectfully,

H. D. PEASE,
Director State Hygienic Laboratory

The foregoing reports were transmitted to Governor Hughes by Commissioner Porter on February 19, 1907.

nary treatment of the sewage, into Hutchinson canal or East Chester bay.

It may be that a careful study of the questions involved may bring out some other means for the proper disposition of the sewage, such, for instance, as the diversion to the proposed Bronx valley sewer of a portion of the sewage of Mount Vernon. The methods to be employed in bringing about the freeing of the river and canal from sewage pollution should, however, be left to the consideration of recognized experts in sanitary engineering employed by the municipalities who are responsible for the polluted condition of the stream.

With reference to the disposition of this matter I would say that I have addressed to the mayor of Mount Vernon and the president of the village of Pelham communications urging them to take up at once the question of a proper disposal of the sewage from these places, stating that this Department would insist that it be done, and that, failing to receive satisfactory evidence that this would be done, the Department would place the case in the hands of the Attorney-General for such an action on the part of the State as the Public Health Law warrants.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *November* 14, 1907.

The Mayor, Mount Vernon, N. Y.:

DEAR SIR:— Recently complaints have been made to this Department with reference to the pollution of the Hutchinson canal by the sewage from the city of Mount Vernon. One of the sanitary engineers of this Department made an investigation, from which it appears that a population of approximately 25,000, or 95 per cent. of the total population, is served by the public sewer system, which discharges through three separate outlets into Hutchinson canal or Hutchinson river, which flows into the canal. About 85 per cent. of the sewage of the city is discharged through the main outlet sewer which discharges into the canal at the foot of Fulton avenue. It appears that other extensions to the sewer system are contemplated.

The sewage of the villages of Pelham and Pelham Manor also discharges into the Hutchinson canal, and the matter of the disposal of their sewage will also be taken up with them at once.

I have before me a detailed report made after a careful study of the conditions by one of our engineers, and it appears from this report that the canal is in an intolerable stage of sewage pollution. There is apparently no question but that a public nuisance is caused by the discharge without purification of the sewage of Mount Vernon and Pelham and Pelham Manor into the waters of the Hutchinson river and canal. It also appears that, although plans for the construction of sewage disposal plant for your city and the village of Pelham Manor were approved by this Department, neither of such sewage disposal plants have been constructed up to the present time.

Both on sanitary grounds and considering the rights of property-owners residing near the Hutchinson canal, the present pollution should be removed by the construction of proper sewage disposal plants to treat the sewage of your city.

Your attention is called to the provisions of the Public Health Law with reference to the discharge of sewage into the waters of this State, and your attention is also directed to the fact that, although the plans for a system of sewage disposal for your city were approved by this Department, at that time it was of course contemplated that the sewage disposal plant would be erected, and at that time it does not appear that any permit was issued for the discharge of raw sewage in the manner in which it has been by your city.

It appearing, therefore, that the city of Mount Vernon has not built and operated sewage disposal plants as required under the plans approved by this Department, and that a nuisance exists by reason of the discharge of raw sewage from your public sewer system, I desire to urge upon you a prompt and careful consideration of the question of the future disposal of the sewage of your city and to say that I will be glad to take this matter up with you and arrange a meeting in which the matter may be discussed with the officials of your city if you so desire.

Failing, however, to receive satisfactory assurances that you propose to give the matter immediate consideration, I shall feel it my duty to take such steps as I can legally for the enforcement of such provisions of the Public Health Law as may apply hereto and to secure better conditions than at present exist.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

MOUNT VERNON, N. Y., *December* 2, 1907.

Hon. EUGENE H. PORTER, *Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Mayor Howe, of our city, has handed to me for reply, your letter to him of the 30th ult. in reference to the discharge of sewage into the Hutchinson canal by our city.

The mayor requests me to say that your communication of November 14th was referred to the sewer committee of the common council which has taken the matter up with a view to remedying matters. It was at that time understood that the chairman of the committee on sewers or the city clerk was to answer your said communication and report what action would be taken in the matter.

The mayor wishes me to assure you that the matter of the disposal of the Mount Vernon sewage is being considered by the city authorities and will be carried to a satisfactory solution as speedily as possible.

Respectfully yours,

J. MORTIMER BELL,

Corporation Counsel

ALBANY, N. Y., *November* 14, 1907.

President of the Village, Pelham, N. Y.:

DEAR SIR:— Complaints have been made to this Department with reference to the pollution of the Hutchinson canal.

A thorough investigation has been made by this Department and I am advised that the sewage of several hundred persons in your village is discharged into the Hutchinson river, and it does not appear that any plans for these sewers were ever approved by the Department as required by the provisions of the Public Health Law.

I therefore bring this matter to your attention and urge that you give it your careful consideration. The Department is taking up with the city of Mount Vernon and the village of Pelham Manor the question of the proper disposal of their sewage and I urge that you give this matter your immediate and careful consideration.

Failing to receive assurances that proper disposition will be made of your sewage and that the steps have been taken to see that the necessary plans required are approved by this Department, I shall feel it my duty to take such steps as I can legally for the enforcement of such provisions of the Public Health Law as may apply hereto, and to secure better conditions than at present exist.

Your attention is called to the provisions of the Public Health Law regarding the matter of the discharge of sewage, approval of sewer plans, etc., and I shall be glad to hear from you with reference to this matter with as little delay as possible.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

PELHAM, N. Y., *November* 29, 1907.

DR. EUGENE H. PORTER, *Commissioner, New York State Department of Health, Albany, N. Y.:*

DEAR SIR.— I am in receipt of your favor of the 14th inst. relative to the sewer plans and sewage disposal of the village of Pelham.

Regarding the former — all the sewers in this village were constructed by private parties (Mr. B. F. Corlies and the Pelham Heights Company) about twelve years ago and all the streets in which they are located were at that time owned and controlled by these parties. Within the past year Mr. Corlies dedicated his streets to the village but the balance of the streets (over 75 per cent.) still remain the property of the Pelham Heights Company and over which the village officials have no control.

As you can readily appreciate the authorities are placed in a rather peculiar position as regards the sewage question in this village but I can assure you the officials will willingly co-operate with your board as far as their jurisdiction extends. I understand that communications have been received by the villages of Pelham Manor and North Pelham relative to this matter and I would, therefore, suggest, that a representative of your board meet in joint conference with the boards of trustees of the villages of Pelham, Pelham Manor and North Pelham in order that the recommendations and requirements of your board may be more fully explained.

Awaiting you reply, I am,

Very respectfully,

S. L. JACQUES,

President

ALBANY, N. Y., *December* 9, 1907.

Mr. S. L. JACQUES, *President of the Village, Pelham, Westchester county, N. Y.:*

DEAR SIR:— I am in receipt of your communication of recent date with reference to the sewers in your village.

I note that these sewers were constructed by private parties and that a few of them have been turned over to the village, but over 75 per cent. remain the property of the Pelham Heights Company.

That being the case I wish to take up, without delay, this apparent violation of the law by this company and wish you would kindly give me the names of the officers of the company and I will communicate with them directly.

A little later on I will endeavor to arrange to meet the officers of your village and Pelham, Pelham Manor and North Pelham, and go into this matter more in detail.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *November* 14, 1907.

President of the Village, Pelham Manor, N. Y.:

DEAR SIR:— Recently complaints have been made to this Department with reference to the pollution of the Hutchinson canal by the sewage from the city of Mount Vernon and the village of Pelham Manor.

A thorough investigation of the situation has been made by the Department and I have before me a detailed report showing the exact situation with reference to the discharge of sewage from the municipalities mentioned.

It appears that a public nuisance is created by the discharge, without purification, of the sewage from the city of Mount Vernon and the villages of Pelham and Pelham Manor, into the waters of the Hutchinson river. Your attention is called to the fact that at the time of the approval of the plans for the sewer system in your village plans for a sewage disposal plant were also approved, which has never been constructed, and no permit has ever been issued for the discharge of raw sewage into the Hutchinson canal by your village, nor was such discharge contemplated at the time of the approval of the plans. I have taken this matter up with the city of Mount Vernon and the other municipality involved, and wish to urge upon you a prompt and careful consideration of the matter of the future disposal of the sewage of your village.

I will be glad to arrange to meet the officials of your village to discuss this matter if you so desire. As the matter is one which cannot be longer delayed, failing to receive satisfactory assurances that the necessary steps will be taken at once to provide for the proper disposal of the sewage of your village, I shall feel it my duty to take such steps as I can legally for the enforcement of such provisions of the Public Health Law as may apply hereto, and to secure better conditions than at present exist.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

PELHAM MANOR, N. Y., *November* 22, 1907.

Dr. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— Mr. C. H. Pond, president of the village, asks me to acknowledge for him receipt of your letter of the 14th inst. about sewage discharge, and to say that the board of trustees would be pleased to meet you or your representative at such time as you find convenient; please give him two or three days' notice.

Yours respectfully,
HENRY N. BABCOCK,
Village Clerk

NEW YORK CITY

CROTON WATER SUPPLY

ALBANY, N. Y., *May* 14, 1907.

Hon. EUGENE H. PORTER, *State Commissioner of Health, Capitol, Albany, N. Y.:*

DEAR SIR:— Governor Hughes directs me to call your attention to the inclosed article in the "New York Times" of this date. He desires to receive a report regarding the matter as soon as possible.

Very truly yours,
ROBERT H. FULLER,
Secretary to the Governor

From "*New York Times,*" May 14, 1907.

CITY WATER IMPURE; CAN'T BE PREVENTED

Health Board and the Water Department say Apgar law is a hindrance.— Supply sources polluted.— And under the statute no more land can be acquired to purify them.— Boiling or filtering advised.

Tied hand and foot by the Apgar law passed two years ago, the board of health and the department of water supply admit that they are absolutely powerless to protect the water of the city from pollution. From many places in the Croton watershed, notably Mount Kisco village and Brewster, sewage drains into the streams which supply the great Croton reservoir, and all the department of health can say is that conditions are not really as bad as they sound.

The safe thing for New Yorkers to do at present, it is pointed out, is either to boil or filter their drinking water.

The worst case is at Mount Kisco. Here a village of 2,000 inhabitants stands in a valley through which runs the Branch brook. In 1890 the city expropriated property along its banks, and moved the houses back until a clear stretch about 100 yards wide is left in the middle. The idea was that by this means the stream would be kept free from pollution. But because the valley is very flat, practically no good has been accomplished, and since then two colonies of Italians have established themselves on the banks of the brook outside the city's property.

Commissioner Oakley took the matter up and desired to acquire more land on either side of the stream. By this means the houses would be removed to the higher land and a proper drainage system could be introduced. The village was perfectly willing to put in the sewers if the department would install a disposition plant on its land to treat the refuse which was handed over to it.

But when the corporation counsel's office was asked to pass upon the plans it was pointed out that by the Apgar law the city was forbidden to acquire any more land for water purposes in the county of Westchester. It did not matter how bad the conditions might be, the law stood in the way and nothing of that sort could be done.

Apparently the only relief at present possible is an appeal to the State Board of Health. If a nuisance dangerous to the public health were proved the board might be able to deal with it. However, Chief Engineer De Varona expressed himself upon that course of procedure freely yesterday. He said:

"Do you know how long it takes to get a nuisance abated in this way? Two years, ten years, a lifetime. Suppose Jones violates the State Board's regulations, we notify the Board, serve him with a copy of the complaint and give him thirty or sixty days' grace. Then the complaint goes before the State Board, and when it gets round to it, it sends an inspector.

"Probably the inspector has a number of other matters to attend to. When he's good and ready he makes his inspection, and then elaborates his report. It has to wait for the next meeting of the Board, if it is not crowded with other business, and has to be fully considered. At last a notice is served on Jones by the State Board. Again, he has sixty days' grace. If he does not abate the nuisance, you think he can be hanged? Oh, no. Then we can bring an action.

"Is this an opera bouffe method, or is it serions? Why, when I went to Brooklyn I reported that one source of water supply was hopelessly contaminated. I recommended that it be abandoned, and it was. Two years later we heard from the State Board that we were at liberty to bring suit against the creators of the nuisance."

As a matter of fact there is now before the Legislature a bill introduced last Tuesday by Senator Carpenter of Westchester to allow the city to take the steps necessary to construct the disposition plant at Mount Kisco in connection with the village's own sewage system. But this only alleviates one danger point.

"There are several other places very nearly, if not quite, as bad as Mount Kisco," said Commissioner O'Brien yesterday. "The only full solution of the difficulty will be the establishment of a filtration basin for all the city's water. You may send 1,000 inspectors up to the watershed to watch the houses, but a single Italian can nullify all their efforts."

All the comfort the health department could give was that there was no need of a scare. It was said a few weeks ago that the increase in the typhoid cases in New York was accountable for by the prevalence of that disease in Mount Kisco. It is asserted, however, that probably the germs were introduced into the city by lettuce, milk or other country produce rather than by water.

However, not one of the officials pretends that the situation is not a very serious one. At any moment an outbreak of disease at Mount Kisco or other places near it might cause an epidemic in New York. The city can do nothing and must wait until the law is altered or a filtration plant established.

ALBANY, N. Y., *May* 15, 1907.

HON. CHARLES E. HUGHES, *Governor of the State of New York,*
Albany, N. Y.:

SIR:— I beg to acknowledge the receipt of your communication of May 14th, by the hand of your secretary, with which was inclosed an article from the "New York Times" under date of May 14, 1907, and under the heading "City Water Impure; Can't be Prevented."

In response to your request for a report regarding this matter, I beg to submit the following:

The village of Mount Kisco, Westchester county, which has a population of about 2,000 people, is situated on one of the tributaries of the Croton watershed, which is a part of the watershed of the city of New York. The watershed of the Croton river and its tributaries form the source of the water supply of a considerable portion of the city of New York and is under the direction of the rules and regulations originally enacted by the State Board of Health and by Justice H. T. Dykman of the New York Supreme Court in 1889, under legislative authority originally conferred by chapter 543, Laws of 1885.

This act provided in part: "Section 7. When the State Board of Health shall, for the protection of a State water supply, make regulations, the execution of which may require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the waterworks shall, at its own expense, construct and maintain such works or means for sewage disposal as shall be approved by the State Board of Health."

The law was amended in 1888 so as to provide for the approval of rules and regulations by either a county judge or the Supreme Court judge of the judicial district wherein the watershed protected was situated.

Acting under the authority of these acts, the State Board of Health, March 15, 1889, made and enacted rules and regulations for the protection of the watershed of the Croton river and its tributaries in the counties of Westchester, Putnam and Dutchess and of so much of the Bronx and Byram rivers and their tributaries in the county of Westchester as were used for supplying water for the city of New York.

These rules and regulations, duly approved by Justice Dykman, were duly published as required by law and thus became operative and have since continued in force. These rules contain a prohibition against any sewage, house slops, sink wastes, etc., being discharged into any lake, spring or stream or being thrown upon or discharged upon the surface of the ground so that they would fall into any stream tributary to the water supply of the city of New York so as to pollute the same.

The village of Mount Kisco, situated as it is on the watershed of the Croton river, some time ago reached a point where a system of sewerage was absolutely essential for the community, for the sanitary welfare of the inhabitants in that village, and also for the protection of the Croton river from a dangerous character of pollution arising from the nature of drainage from privies, cesspools, etc. In other words, the time arrived some time since when the conditions contemplated in the above law, section 85, have been reached and the execution of rules and regulations duly enacted thus "require the providing of some public means of removal or purification of sewage" from and for the village of Mount Kisco.

These facts were brought to the attention of the proper officials of the water department of the city of New York by the State Commissioner of Health some years ago, and, acting upon and under such notices, the New York city water department entered into an agreement with the village of Mount Kisco by which the village should build and maintain its own system of street sewers and the New York city water department should build and maintain a system of sewage disposal to provide for the removal and disposal of sewage from said village street sewers. Plans for the sewer system and the sewage disposal plant were submitted to this Department for approval over two years ago. After a careful examination by the consulting engineer of the Department they were returned to the authorities of the city of New York for correction, and there was then a long delay in securing the resubmission of the plans by the New York city water department.

Communications were sent to them and to the commissioner of health of the city of New York urging that the matter receive the attention of the New York city authorities and that the plans be returned so that they might be approved and the construction of the sewer system and the sewage disposal plant facilitated.

Failing to secure the resubmission of these plans, the matter was placed in the hands of the former Attorney-General, and as a result, I believe, of his communication with the authorities of the city of New York the plans were finally returned to this Department. They were carefully examined by the consulting engineer, who recommended their approval, and another agreement was prepared between the village authorities and the city of New York as to the construction of sewage disposal plant, etc.

This agreement was signed by the Mount Kisco authorities and after having been signed by them was sent to the authorities of the city of New York, and for a long time no action could be obtained.

The Attorney-General was again asked to take this matter up and as a result of his investigations there was finally sent to me a communication from the New York city department of water supply, gas and electricity, together with an opinion by Mr. H. T. Dykman as special counsel. This opinion recites the fact that the question involved, as briefly stated, is: "Is the city of New York under obligation or liability to construct or maintain a system of sewerage in the village of Mount Kisco?" This opinion recites all the facts in the case and answers the question in the negative. It appears by this opinion that Mr. Robert G. Monroe, former commissioner of water supply, gas and electricity for the city of New York, in 1902 requested an opinion from the corporation counsel of the city of New York as to the city's obligation under the Public Health Law to construct a sewer system for the village, the matter having been brought to his attention by a communication from Professor Landreth to Dr. Daniel Lewis of the State Department of Health, dated June 26, 1902. Mr. Rives, as corporation counsel, referred the matter to Mr,

H. T. Dykman of White Plains, who was then and had been special counsel for the city in such matters.

Under date of July 1, 1902, Mr. Dykman reported to the corporation counsel, holding that the State of New York had not made it impossible for the village to adopt a sewerage system as indicated by Mr. Landreth; that the Public Health Law did not, in his opinion, contemplate the construction of a sewerage system by the city under the circumstances existing at Mount Kisco; that the State Commissioner of Health had power to abate any temporary source of contamination and that the city had not proceeded under the Public Health Law in protecting its interest at Mount Kisco, but that it had acquired such property in fee as was deemed necessary, etc.

This report was approved by Mr. Rives and it is set forth in an opinion that the proposition that the city can be compelled to construct and maintain at its own expense the sewerage system for the village of Mount Kisco is unjust and unreasonable and should not be allowed until sustained by the courts.

It further says that the city should resist any attempt on the part of the State Department of Health to impose a burden of this kind upon the city.

This opinion also points out that the way of keeping the water supply pure "may not be the expensive one of building systems of sewerage for any locality which gets up a popular outcry and appeals to personal and political influence, but the remedy may rather be by prosecuting civilly and criminally those who break the law."

The corporation counsel further says that his department will, upon request and upon being furnished with proper evidence, try this remedy. It would appear, therefore, that aside from the remedy provided in the Public Health Law, which appears to be difficult of operation, that the corporation counsel has already pointed out to the city officials that there is a further remedy at their command.

Failing, therefore, in its attempt to secure an agreement between the authorities of Mount Kisco and the city of New York, which would relieve the situation, I wrote the Attorney-General stating that as the opinion of the acting corporation counsel apparently denied that the city of New York could be compelled to construct or maintain this sewer system or sewage disposal plant for the village of Mount Kisco, and indicating that any action to compel this would be resisted in the courts, I would like to be advised what action I should take in this matter and what I could do to facilitate some final action, which I deem necessary in order to relieve the situation existing on the watershed.

In his reply to my communication, he said that he thought it was advisable to approve of these plans and give notice of such approval to the proper authorities. That this was a preliminary that would have to be taken before any legal proceedings could be instituted, which would undoubtedly be necessary to compel the city of New York to act in the matter.

I therefore affixed my approval to the plans and returned the same to the proper officials of the village of Mount Kisco with a notice to that effect.

I might add that the situation was further complicated by the passage of chapter 738, Laws of 1905, referred to in the article sent me as the Apgar law, the effect of which is to prohibit the city of New York from acquiring, for the purpose of increasing or improving the water supply, any lands or streams within Westchester or Putnam counties, except that the act does not apply to the Cross river reservoir, the contemplated reservoir at or near Croton Falls, nor to the contemplated acquisition of the land in the vicinity of Rye lake.

After the approval of the plans they were returned to the authorities of the village of Mount Kisco as herewith set forth. I had a conference with the president of the village of Mount Kisco in which he advised me that no steps had been taken in the matter to relieve the existing conditions and that it was the opinion of the people of Mount Kisco that the State Department of Health should take some action in the case to compel the city of New York to construct and maintain this sewerage system and sewage disposal plant.

I thereupon wrote the Attorney-General, under date of March 11, 1907, reciting to him the facts above set forth and asking him to advise me as to whether I had authority to begin any proceeding which would be effective in determining the question at issue. Further, I asked him to advise me that if I had such authority, what further action I should take, and, if I had no such authority and it was the duty of the officials of the village of Mount Kisco to begin some proceeding, that he would indicate what form of action or proceeding should be begun by them.

To that communication I have received no reply.

I also held a conference in the city of New York with the commissioner of health and the commissioner of water supply, gas and electricity, at which the situation at Mount Kisco was gone over and at this meeting I assured the city officials that the State Department of Health would do anything in its power and arrange to send the Consulting Engineer of the Department to make a personal inspection.

Subsequently the Consulting Sanitary Engineer of the Department and Dr. Pease, the Director of the Laboratory, paid a personal visit to Mount Kisco and the adjoining towns for the purpose of studying the outbreak of typhoid fever and investigating local conditions. An inspector of the Department was also sent there for the purpose of locating conditions that should be abated and evidence was secured of a number of cases where the rules were being violated and where there was danger of the pollution of the water supply.

As a result, peremptory orders, directed to the presidents of the boards of health of Katonah, Mount Kisco and Brewsters, were issued which ordered that the board of health should at once be convened and immediate steps taken toward the abatement of the specific instances outlined in the order. Our inspector was directed to make a subsequent inspection of these places to see if the orders of the local board of health were complied with.

The Montefiore Home, on the Croton watershed, has submitted plans for a sewage disposal plant for the institution, which have been approved by the Department and the plant will be installed at once.

I beg to call your attention to the fact that while the statement attributed to Chief Engineer De Verona in the article in question as to the length of time which it takes to abate a nuisance by procedure under the Public Health Law may be correct, that during my term of office no violations of these water rules have been recorded by this Department under the procedure enacted by the law, and I therefore had no opportunity to test the matter. Apparently the city of New York has been proceeding as indicated in the opinion of the special counsel, not under the provisions of the Public Health Law in protecting its water supply, but has relied upon the power of condemnation, etc., which, as I understand it, was declared away by the provisions of the so-called Apgar law.

Your attention is respectfully called to an act which has just passed the Legislature, introduced in the Senate by Senator Carpenter, of Westchester county, entitled "An act to authorize the city of New York and the village of Mount Kisco, Westchester county, New York, to enter into contract or agreement to provide for the disposal of the sewage of said village and to allow the city of New York to acquire such lands as may be necessary in and about said village and to raise funds to carry such contract or agreement into effect." The effect of this act, should it become a law, and the agreement be entered into, probably would relieve the situation at Mount Kisco without further delay.

This entire matter is a subject that has been of grave concern to the Department and I have been ready and willing at all times to take any action in the matter which would facilitate the construction of a sewer system for the village of Mount Kisco and relieve the apparently dangerous conditions.

I recently sent to Health Commissioner Darlington a communication in which I urged upon the city of New York the construction of a modern filtration plant, as being, in my judgment, the only safe and proper way to adequately protect the water supply of the city. If the Attorney-General advises me that I have authority to commence an action in this matter which will relieve the situation, I shall do so at once. It is apparent, however, if litigation must be entered into over the matter at issue, that it will defer any relief of the existing conditions for several years. The end sought is a speedy removal of the existing conditions which can only be accomplished by a modern sewer system with a sewage disposal plant for the treatment of the sewage.

If the bill above referred to does not accomplish the desired effect the subject is one which might very properly become a matter for legislation but as to the form such legislation should take it would appear to be a subject for careful study.

I beg to inclose you herewith copies of the report of Mr. Horton, Consulting Engineer of the Department, Dr. Pease, Director of the Laboratory, and Mr. Wachter, upon his investigations made by them of the conditions at Katonah and Mount Kisco.

The Department, while always willing and anxious under circumstances of this kind or in an emergency to do anything in its power to assist the city of New York, cannot justly be expected to undertake continuous and detailed protection of its extensive watershed. Such protection, thorough and systematic, is provided for and intrusted to the city department of health and of water supply, gas and electricity. In this important work the State Department will gladly aid.

Very respectfully,
EUGENE H. PORTER,
State Commissioner of Health

STONY POINT.

NEWBURGH, N. Y., *July* 9, 1907.

State Department of Health, Albany, N. Y.:

DEAR SIRS:— Mrs. Ada Allison, E. O. Rose and another, of Stony Point, own some property there upon which there is a lake. In hot weather there is not much water flowing into the lake; there is no outlet thereto and the water, of course, becomes stagnant and there is considerable vegetable growth therein, and the same is unhealthy and causes malaria and fever.

I own property in that locality and members of my family in past summers have become ill from the unhealthy condition of this water.

I wish to call your attention thereto as the same should be remedied.

Very truly yours,
MARY STUART

ALBANY, N. Y., *July* 11, 1907.

MRS. MARY STUART, 166 *South street, Newburgh, N. Y.:*

DEAR MADAM:— I am in receipt of your letter of July 9th referring to the conditions existing in the lake at Stony Point.

I have referred the matter to the Sanitary Engineering Division of this Department who will give it their immediate attention, and if it comes within the jurisdiction of this Department, I can assure you that the matter will receive prompt attention.

Very respectfully,

EUGENE H. PORTER,

Commissioner of Health

STONY POINT, N. Y., *July* 29, 1907.

HON. CHARLES E. HUGHES, *Albany, N. Y.:*

DEAR SIR:— I regret the necessity of troubling you upon this matter. There is a pond (artificial) situated near the Stony Point Park that is a source of danger to health. For several years I have tried to have something done about it through local authorities and have also referred it to the State. August is approaching, the slime and slum are in progress in this pond and the growth going on. It appears that August is the worst month of all — so many mosquitoes, and so much malaria. Last summer four of my family suffered and nearly died from the various forms of fever we became infected with here. It is also a great damage to the sale of property. The owners put one off with the statement that they will form a lake, but this is only with a hope on their part that the State may buy it some day, but aside from this possibility it could be opened in the meantime and allowed to drain off into the creek, thence into the Hudson. For forty years Mr. and Mrs. Ten Eyck lived upon their place and they and all who went there enjoyed health. About the time the State was talking of buying for a park Mr. Watson Tomkins concluded to board up this marsh into which a brook flowed and make an ice pond. (It was said so the property would be worth more in case the State had to have it for a road.) Anyway the work was poorly done, and ever since the whole community have suffered.

I who have come here from year to year for many years can appreciate the danger and difference. I will inclose a letter sent to my sister. She called upon and saw the Sanitary Engineer who was or is in Newburgh and he said wait a couple of weeks, which only brings on the added danger of August weather. I am quite sure this matter was looked into last winter, and that the Stony Point people held a meeting and the result is just this, put off, if Mrs. Alison and her sister who promised me three years ago it should receive immediate attention. 'At that time Mr. Jones suffered from severe fever for three months. We were obliged to return to Hackensack and I refer you to Dr. Adams of that town. I am sure if you knew half of the suffering, to say nothing of the damage to real estate and the getting of boarders, etc., you would start the proper amendment of this outrage and neglect. In fact I have the utmost confidence that the matter will no longer be dallied with, and, therefore, I am

Very respectfully,

MRS. R. M. JONES,
Hackensack, N J.

327 Broadway, N. Y. (my husband's address).

ALBANY, N. Y., *August* 1, 1907.

HON. EUGENE H. PORTER, *State Department of Health, Albany, N. Y.:*

DEAR SIR:— Inclosed please find a letter addressed to Governor Hughes by Mrs. R. M. Jones of Hackensack, N. J., who forwarded to the Governor your letter of the 11th ult. addressed to Mrs. Mary Stuart, 166 South strret, Newburgh, N. Y.

Will you kindly inform the Governor what steps have been taken in the case to which Mrs. Jones refers?

Very truly yours,

ROBERT H. FULLER,
Secretary to the Governor

ALBANY, N. Y., *August* 2, 1907.

Hon. CHARLES E. HUGHES, *Governor of the State of New York, Albany, N. Y.:*

DEAR SIR:— In compliance with a request from Secretary Fuller, received at this Department to-day, to inform you as to the steps taken by this Department in the matter of complaint made to you by Mrs. R. M. Jones of Hackensack, N. J., I would advise you as follows:

During the fall of 1906 the health officer of the town of Stony Point reported to this Department the unusual prevalence of malarial fever, and I instructed one of the medical experts connected with the Department to investigate the local conditions.

It was found that throughout the lower area between the river and high ground, much of which had been excavated for brick clay, there were many basins filled with stagnant water, and to the north of the village there was found a body of water artificially constructed by a dam at either end, making a narrow, winding pond partly filled by a small stream and spring, but so existing that there was marshy ground about and half submerged land.

This is no doubt the pond referred to by Mrs. Jones.

There being no doubt but what the stagnant water was being used by mosquitoes for breeding purposes, and it being recognized that they were a medium for the spread of malarial fever, the local health officer was instructed as to the remedy to be used to destroy their breeding places in that vicinity.

He was instructed to lay the matter before the local board of health and was advised that this Department would be pleased to offer further advice in the matter if requested.

Nothing further was heard of the matter until the 11th of last month, when a letter was received from Mrs. Mary Stuart, residing at 166 South street, Newburgh, N. Y., complaining of existing conditions.

The matter was immediately taken up with the local health officer, and he was requested to advise me as to whether the conditions were such as to justify its characterization as a public nuisance.

On the 18th of July I received a letter from Dr. Sengstacken, the local health officer, in which he stated that the board of health had tried to rectify the trouble, which was undoubtedly a nuisance, but that the board had met with resistance.

I informed him on the 31st ult. that the matter could be brought to a satisfactory end by proceeding under the provisions of the Public Health Law, as outlined in sections 25a, 25b, 25c and 25d, and requested him to take the matter up with the local board of health with a view of draining the water-covered areas or taking such other steps as might be necessary to abate the nuisance.

Very respectfully,
EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *August* 8, 1907.

MR. ALEXANDER ROSE, *President Board of Health, Town Stony Point, Stony Point, N. Y.:*

DEAR SIR:— Several complaints have been made to this Department with reference to conditions existing in Stony Point caused by accumulations of water which it is alleged become stagnant and cause a very insanitary condition.

An examination was made by one of the medical experts of the Department last year and a copy of his report was sent to the health officer with the request that he lay the matter before your board and that your board give the matter immediate consideration. It is evident that no action has been taken by your board. I recently advised the health officer that in my opinion your board should take action as outlined in sections 25a, 25b, 25c and 25d, and suggested that he take the matter up with the board at once with the view to draining these water-covered areas or covering them with oil. It seems to me that the prevalence of malarial fever and the well-known relation of swamp areas to the disease would justify your board in incurring considerable expense to remove these nuisances, the expense of which, according to law, should be charged against the property benefited, which should, of course, include the adjoining residences.

The matter is brought to your attention with the hope and expectation that you will give it immediate consideration, and I would suggest that you call the board together and take prompt action in the matter.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

ALBANY, N. Y., *August* 21, 1907.

Mr. JOSIAH FELTER, *President Board of Health, Town of Haverstraw, Haverstraw, N. Y.:*

DEAR SIR:— Some time ago complaint was made to this Department with reference to the unusual prevalence of malarial fever in the town of Stony Point. The Department investigated and found that in time of low water there is a lake at Stony Point that becomes stagnant. We advised the local board of health that they should proceed under section 25 of the Public Health Law, and I am now notified by the president of the board that the town of Stony Point adjoins the town of Haverstraw and that there are many places in the town of Haverstraw which are of a similar character, places which have been complained of in Stony Point.

In my judgment places in the town of Haverstraw should be cleaned of their insanitary features and I am bringing the matter to your attention at his request, and suggest that your Board consider the subject at their next meeting and take such action as appears to be necessary.

Very respectfully,

EUGENE H. PORTER,
Commissioner of Health

INSPECTION OF RENDERING PLANTS

REPORTS OF INSPECTORS OF RENDERING PLANTS APPOINTED UNDER EXECUTIVE ORDER

BARREN ISLAND

Report for the year 1907 *on the Barren Island District*

NEW YORK, *January* 15, 1908.

Dr. E. H. PORTER, *State Health Commissioner, Albany, N. Y.:*

DEAR SIR:— The Sanitary Utilization Company, during the year 1907, received and disposed of 316,200 tons of garbage from Greater New York, the majority of this being disposed of in what they call their Brooklyn building, although some was disposed of through the New York building. During this year they have erected a concrete chimney, 225 feet in height, with an internal diameter of seventeen feet. This is connected with the two digester buildings, known as the Brooklyn and New York buildings, and to their dryer plant. By this chimney connection they propose to ventilate these buildings, and carry whatever gases or fumes may arise into same, which they think will be destroyed from heat of the boiler connections, and being of such a height, that there should be no complaints from any of the surrounding districts.

They have inclosed the buildings which were started last spring, so that they are practically completed: they had a slight fire in the early summer in what they call the Brooklyn building, but it did not interfere with their receiving and disposing of the garbage. They have thought of making some little improvements in the early spring, so as to keep their plant as perfectly sanitary as possible. They are so thoroughly equipped now that they could handle double the amount of garbage that they are now receiving.

White Brothers.— Have been running their plant steadily during the year, taking care of the offals from the city of New York and the borough of Richmond; also a certain amount of garbage from the several hotels of New York. The approximate number of carcasses removed to this plant from the boroughs of Manhattan and Richmond is fourteen thousand four hundred and thirty-three (14,433). They have been very particular in keeping this plant up to the sanitary requirements, using plenty of disinfectants; building is kept perfectly clean with whitewash, and so far no cause for complaint.

McKeever Brothers.— Have been taking the offals from the boroughs of Kings and Queens, and from those two boroughs they have received carcasses numbering four thousand eight hundred (4,800). Their old plant, which was a frame building, is ready to be abandoned, as they have built a new concrete building, two stories, and will move their machinery in for working purposes within the next thirty days, and they propose to have this plant as nearly perfect as to sanitary requirements as possible. A new style condenser, which is a device of their own, to take care of the gases and fumes, seems practical for the purpose, but the certainty will be when the machine is in operation.

The Coe Phosphate Works.— Have been closed down practically all summer, no work being done there until within the past month. They have carpenters working, fixing up their old plant for the purpose of starting a grinding plant to be used in connection with the paint business, so that I will not be able to give you a report on the operation of this new business until they start up, which will probably be in two or three months.

The complaints rendered by the people of Lawrence last summer were looked into by your inspector and a full report was rendered to you which you have on file.

Yours very truly,

B. F. HAMILTON,

Inspector

CHEEKTOWAGA

Yearly Report on the Rendering and Garbage Works of Cheektowaga

BUFFALO, N. Y., *January* 1, 1908.

DR. EUGENE H. PORTER, *State Commissioner of Health, Albany, N. Y.:*

The Buffalo Fertilizer have not expended anything for improvements to their buildings in the past year. Their entire plant, as far as buildings are concerned, are in first class shape.

For the year ending December 31, 1907, they received and disposed of the following material: 644 horses, 201 cattle, 3,219 hogs, 2,501 sheep, 349 calves, 850,171 pounds of wet tankage, 2,888,808 pounds of wet bone, 40,723 sheep heads, 249 calves heads, 4,371 calves feet and 5,903 setts.

Their rendering plant consists of five tanks, three coolers, one dryer, the capacity of which is eighteen tons of tankage and fifty tierces of grease daily. The grease extracting plant consists of two tanks with all modern appliances, giving this department a capacity of twenty tons of tankage and twenty tierces of grease daily.

Their plant has been running continually and they have increased their business for the year 1907 over the year 1906.

The American Agricultural Chemical Company (Milsom works) have for the year ending December 31, 1907, received and disposed of the following: 7,200,000 pounds of butcher shop fat, bones, etc., 1,950,000 pounds of horses, cattle, sheep, hogs (10,000 head), 8,750,000 pounds of fresh slaughter-house carcass stuff, etc., 12,000 hides, skins, pelts, etc., 5,500,000 pounds of miscellaneous material and 25,000,000 pounds of dry merchantable tankage stock.

The expenditure for improvements to buildings, etc., amounted to very little in the past year as all of their buildings are in good condition.

They operate twelve rendering tanks, the capacity of which vary from five to eight tons according to the materials handled; these tanks are operated the year round.

I am familiar with the manner in which they conduct their plant and their machinery and equipment are installed according to all requirements of the State Board of Health, thus conducting their business in as satisfactory and sanitary manner as possible in view of the class of materials they destroy or manipulate.

All stuff that is at all objectionable is given their prompt and thorough attention.

The Baynes Garbage Reduction Company have received and disposed of 49,000,000 pounds of garbage for the year ending December 31, 1907, which is a decrease of 1,195,300 pounds for the year 1906.

The largest quantity of garbage received in any one day during the past year was 271,230 pounds, which was on the 18th day of September.

They expended during the year the sum of $5,225 in maintaining the sanitary efficiency of their plant.

Their plant is equipped with four horizontal tubular steam boilers of 125 horse power each as usually rated. Their motive power consists of two steam engines of seventy-five horse power each, one mill engine of fifty horse power, one dynamo engine of twelve horse power and several steam pumps for furnishing the water supply.

They have in use twenty-one rotary driers, four extractors for extracting the grease from the material and two mills for grinding the tankage.

Their works have been in continuous operation and the garbage has been promptly disposed of in a thorough sanitary manner.

The Buffalo Reduction Company have expended in the past year for improvements the sum of $9,700, which consists of additional improvements to their rendering plant amounting to $2,000 and a new fertilizer shed (not completed) amounting to $7,700 exclusive of machinery.

For the year ending December 31, 1907, they have manufactured 330,502 pounds of grease and tallow and 1,584 tons of tankage.

Their rendering plant consists of two rendering tanks and one dryer. The second floor is used for skinning purposes. The light is furnished by a generator which is run by a small twenty horse power engine, the same being located in the boiler-room.

The extractor building contains two extractor tanks and is operated by an engine and necessary machinery. The water is supplied by the Depew & Lake Erie Water Company and has a pressure of 135 pounds, the main being six inches.

Their plant has been running right along although they have not done the amount of business they did the previous year. There is no doubt but what their business will increase considerable as soon as their new building is completed.

As heretofore, it is my custom to pay regular visits to the different plants and I am pleased to say, that in the past year, I have had less complaints than I have had in any previous year.

I sincerely hope that the different rendering and garbage works at Cheektowaga have been running in a satisfactory manner to you, while I remain,

Yours obediently,
JOHN T. CLARIS,
Inspector

ROCHESTER TALLOW COMPANY

Regular reports of weekly inspections of Inspector Montgomery E. Leary have been received every two weeks as to the sanitary condition of the plant of the Rochester Tallow Company.

These reports show the plant to have been kept in sanitary condition, minor nuisances having been cared for from time to time.

SPECIAL INVESTIGATIONS

SPECIAL INVESTIGATIONS

OSWEGO RIVER WATERSHED

ALBANY, N. Y., *April* 30, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I beg to transmit herewith the report of Prof. H. N. Ogden, Special Assistant Engineer, covering an investigation of the pollution of Oswego river and its tributaries.

This investigation represents the first of a series of investigations of the sanitary conditions of the watersheds of the State which you have directed me to have carried out by the Engineering Division. The sanitary inspections in the field and the collection of statistical data were performed by engineering inspectors especially appointed for this work, acting under the immediate direction of Professor Ogden.

I have carefully reviewed the accompanying report of Professor Ogden and beg to express my concurrence in the findings and conclusions therein stated.

Respectfully yours,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *April* 30, 1907.

MR. THEODORE HORTON, *Chief Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR:— In accordance with your directions I beg to submit the following report of the investigation of the pollution of the Oswego river and its tributaries.

On June 30, 1907, a preliminary report was submitted to you covering the work which had been carried out up to that time, and included principally the examination into and studies relating to the pollution of these waters by domestic sewage. Accompanying the report was a drainage map of the watershed area and a diagram showing the relative density of the resident population.

Since the submission of this preliminary report, the investigation has been continued to include an examination of the character and amount of factory wastes discharged into the streams from the various industrial establishments situated upon the watershed. The State Commission of Health has also authorized an investigation by the State Hygienic Laboratory of the chemical quality of the river water at several points of its course, with a view to throwing more light on the actual present contamination. I am thus able, at this time, to include the results of these investigations and studies and to submit the final report on the subject.

The State of New York contains six large drainage systems, viz.:

1. The streams flowing northerly into Lake Ontario and the St. Lawrence.
2. Those flowing easterly into Lakes Champlain and George.
3. Those tributary to the Hudson and Mohawk rivers.
4. Those flowing southerly into Chesapeake and Delaware bays, tributary to the Susquehanna and Delaware rivers.
5. Those flowing westerly into the Niagara river and into Lake Erie.
6. Those flowing westerly into the Mississippi river, tributary to the Allegheny river.

Of these systems, the first is the largest, though it must be subdivided into a number of subsidiary areas, as follows:

A. The St. Lawrence river area, containing the Racquette and the Oswegatchie rivers.
B. The direct Lake Ontario drainage.
C. The Black river drainage.
D. The Oswego river drainage.
E. The Genesee river drainage.

Of these five distinct areas, the Oswego river drainage area is not only the largest, but also the most important, containing in its watershed a country of splendid resources, thickly settled, containing important cities and many flourishing villages, and covered with a network of railroads. The Erie canal which crosses the area, east and west, has built up along its banks numerous industries, depending on cheap water transportation and the extensive water power on the Oswego river and its tributaries has caused the development of many others.

A striking feature of this district is the collection of inland lakes, also of importance to manufacturing interests. No less than eleven of these lakes exist in the district, varying in size from Cazenovia lake, the smallest (area 2.8 square miles), to Oneida lake, the largest (area 80.9 square miles). Cayuga and Seneca lakes, each with an area of about 66 square miles, are of great importance in regulating and making uniform the run-off from their large drainage areas.

The entire area of the State, exclusive of Long Island, is about 48,000 square miles, divided approximately among the different watersheds as follows:

	Square miles.	Square miles.
1. St. Lawrence river	4,485	
Lake Ontario	14,600	
		19,085
2. Lakes George and Champlain		1,520
3. Upper Hudson river	4,500	
Mohawk river	3,500	
Lower Hudson river	5,025	
		13,025
4. Delaware river	2,870	
Susquehanna river	5,500	
		8,370
5. Niagara river	2,150	
Lake Erie	2,025	
		4,175
6. Allegheny river		1,825
Total area of the State		48,000

Of these areas, the St. Lawrence area, the Upper Hudson area and the Black river area, nearly 12,000 square miles, are included in the Adirondack wilderness, leaving 36,000 square miles of inhabited area, of which the Lake Ontario drainage area of 14,600 square miles is more than one-third. In this Lake Ontario area there are three large streams with their drainage areas as follows:

Black river	1,860 square miles
Oswego river	5,013 square miles
Genesee river	2,500 square miles

The remainder of the Lake Ontario drainage comes from Jefferson and Oswego counties on the east, from Niagara, Orleans and Genesee counties on the west and from a portion of Wayne county in the center in small and unimportant if frequent streams.

The Oswego river drainage, therefore, of 5,013 square miles is over one-third of the Lake Ontario drainage, about one-seventh of the inhabited drainage and between one-ninth and one-tenth of the entire area of the State.

The drainage area of the Oswego river occupies the entire central portion of New York State, reaching from the city of Rome on the east to within ten miles of the city of Rochester on the west, a distance of about 100 miles, and from Lake Ontario on the north to within thirteen miles of the Pennsylvania State line on the south, a distance of about ninety miles. It embraces the finger lake region of the State and reaches through Oneida lake and its tributary, Fish creek, to the very foothills of the Adirondacks. It includes the great Cicero and Montezuma marshes. It is traversed by the Erie canal, which cuts across and interrupts the natural waterways, intercepting a large part of the water naturally stored in the lakes of this watershed.

The area is a great plateau, though deeply dissected by broad river and lake valleys. The geological formation is Devonian sandstone and shale, with layers of limestone, all nearly horizontal. The hilltops frequently rise to elevations of 1,500 to 2,000 feet above sea level and the valleys rise from the level of Lake Ontario, elevation 246, to the level of Cazenovia lake, elevation 1,190, which is on the top of the plateau. Along the southern boundary of the plateau where the divide between the finger lake region and the Susquehanna river is found, near Elmira, for example, the plateau level is depressed, having there an elevation of about 980 feet, rising, however, on the east, south of Cazenovia, to about 1,400 feet, and on the west, south of Canandaigua lake, to about 1,500 feet. Along the northern side the plateau ends in an escarpment generally quite pronounced, which rises at a distance of about ten miles from Lake Ontario to an elevation of about 200 feet above the level of that lake, causing the waterfalls in the Oswego river as well as in the Genesee and Niagara rivers. The lands drained by Fish creek on the north are low, at an elevation of only about 500 feet above sea level, though the head waters on some of the branches reach elevations of 1,000 feet. The entire region has, therefore, well-marked topographic features, and their effect on the slopes both of the surface of the ground adjacent and of the surface of the streams themselves is very marked.

River Slopes

The main river rises from Lake Ontario at an elevation of 246 by a series of dams, utilized for water power in the city of Oswego and at Minetto, about forty feet in the first five miles. At Fulton, about twelve miles from the lake, it has reached an elevation of 345 feet, or 100 feet above the lake, and at Three River Point, twenty-three miles from the lake, where the Seneca and Oneida rivers unite to form the Oswego, the level is about 360 feet above the sea, the dams at Fulton and Phœnix furnishing additional power.

ONEIDA LAKE has four small tributaries — Fish creek, with its east and west branches, emptying into the northeast corner, draining a thinly settled portion of Oneida county; Wood creek, which joins Fish creek at its mouth and drains the central portion of Oneida county, and which receives the greater portion of the sewage of the city of Rome; Oneida creek, which empties into the southeast corner of the lake, and which receives the sewage of the city of Oneida; and Chittenango creek from the south, Chittenango and Cazenovia being two small villages on this stream. These four streams are generally slow in their lower reaches, their slopes being as follows:

Fish creek to the junction of the two branches, about fifteen miles, with a difference of level of thirty feet or a grade of two feet per mile.

Wood creek to Rome, about fifteen miles, with a difference of level of fifty feet or about three feet per mile.

Oneida river to the city of Oneida, about eighteen miles, with a difference of level of forty feet or about three and one-third feet per mile.

Chittenango creek, to the village of Chittenango, about eighteen miles, with a difference of level of fifty-five feet or about three feet per mile.

These streams in their upper reaches, like all those on the Oswego watershed, are torrential in character, rapid, violent streams at certain times of the year and at other times shallow and small.

The head waters of Fish creek are in the town of Williamstown, the valley elevation being about 670 feet. Wood creek ends in Lee township at an elevation of 560 feet. Oneida creek starts in the town of Smithfield at an elevation of about 1,300 feet, and Chittenango creek is the outlet of the Erieville reservoir which has an elevation of 1,504.

Seven miles above Three River Point, the outlet of *Onondaga lake*, elevation 364 feet, discharges into the Seneca river. This lake receives all the sewage of the city of Syracuse as well as the refuse of the manufacturing establishments on its shores and is consequently much polluted. The two tributaries are the Onondaga creek, draining territory to the south to a distance of about twenty miles and rising to an elevation of about 1,200 feet; and Nine-mile creek, the outlet of Otisco lake, which has an elevation of 784 feet.

About seventeen miles above Three River Point, and forty miles from the lake, the village of Baldwinsville utilizes the power obtained from a low dam across the river, the elevation above the dam being 374 feet, or ten feet above Three River Point.

From Baldwinsville to Cayuga lake and the junction with the outlet of Seneca lake is about thirty-six miles, the elevation of Cayuga lake being 381 feet, a rise of seven feet or a grade of the river surface of a little more than two inches per mile, making the stream, therefore, slow and tortuous. Between Baldwinsville and Cayuga lake, the outlets of Skaneateles and Owasco lakes enter; the former, elevation 867 feet, is the water supply of the city of Syracuse and its waters are kept pure for that purpose. The outlet is, however, polluted by the sewage of the village of Skaneateles. This outlet has a fall of 493 feet but the factories and small villages which formerly depended on this water power have been practically wiped out in the diversion of the water to Syracuse.

OWASCO LAKE has an elevation of 710 feet and the fall to the river is largely used for power. Dams within the city of Auburn absorb about one-half of the fall. There are also smaller powers at Throopville and Port Byron. The headwaters of Owasco lake approach in a swamp near Freeville the headwaters of Fall creek, one of the tributaries of Cayuga lake, at an elevation of 1,045 feet. Owasco lake is used as the water supply of Auburn and pollution of the lake water is carefully guarded against. But the outlet is badly polluted by the city and the villages on the banks.

CAYUGA LAKE, extending southerly about forty miles, and with a width of from one to two miles, has only small tributaries. The main inlet approaches one of the tributaries of the Susquehanna about eight miles south of the lake at an elevation of 1,020 feet. The city of Ithaca discharges its sewage into the south end of the lake and a number of small villages indirectly contribute to its pollution. But the natural sedimentation occurring in so large a volume of water undoubtedly prevents any effect on the Oswego river.

SENECA LAKE, about the same size as Cayuga lake and parallel to it, thirteen miles west, is sixty-three feet higher, the fall being utilized at the villages of Waterloo and Seneca Falls where there are extensive manufactories, and much contributing pollution. The city of Geneva at the north end of the lake and the villages of Watkins and Montour Falls at the south end discharge sewage directly into the lake, the village sewage being neutralized, however, by the lake sedimentation. The inlet of Seneca lake approaches a tributary of the Chemung, a branch of the Susquehanna, near Horseheads at an elevation of 975 feet.

KEUKA LAKE, about half the size of Seneca lake, is about seven miles west discharging into Seneca lake about fifteen miles from the north end. It is at an elevation of 709 or 265 feet higher than Seneca lake. The power available is utilized at a number of sites, some of them within the village of Penn Yan which is at the north end of the lake. This village takes its water supply from the lake and the shores of the lake are carefully guarded against pollution and the village purifies its sewage before allowing it to go into the outlet so that the pollution from this source especially in view of the subsequent sedimentation in Seneca lake is very small.

From the north end of Cayuga lake, the main stream continues westerly twenty-three miles to Lyons where the Canandaigua outlet and Ganargua creek unite to form the Clyde river. At the junction, the river has an elevation of about 390 feet, or is ten feet higher than at Cayuga lake, a slope of about five inches per mile.

CANANDAIGUA LAKE is about thirty-two miles from Lyons and is about 300 feet higher, elevation 686 feet, the fall being utilized in small factories at Chapinsville, Shortsville, Manchester and Phelps. All these villages together with the village of Canandaigua discharge both their sewage and factory wastes directly into the stream with no opportunity for sedimentation. The inlet of Canandaigua lake approaches the head waters of the Cohocton river, a tributary of the Susquehanna, at an elevation of 1,370 feet.

The other branch at Lyons flows westerly, gradually rising to its source near Rochester where it has an elevation of about 600 feet. A tributary, Mud creek, comes in from the south rising at an elevation of 1,200 feet just west of and nearly to the south end of Canandaigua lake. On Ganargua creek are the two villages of Palmyra and Macedon, both directly polluting the stream.

Surface Slopes

The surface slopes have already been suggested by the topography, just described. The country is flat and nearly level around Lake Ontario. Easterly to Rome and southerly to a distance of about twenty miles from the lake for the entire distance from Syracuse to Macedon, the general level differs but little from place to place, resulting in a sluggish flow in the main river, the erosion of the banks and the alluvial character of the soil making the stream turbid and discolored in times of flood.

South of this region, the tributaries have steep slopes although the main valleys, generally about a mile wide, have only a moderate and gradual slope. These bottom lands offer good farming facilities, are entirely deforested and are highly cultivated. The surface slopes rising at right angles from these main valleys, however, are steep and even precipitous and the same is true of the banks of all the lakes except Oneida and Onondaga which are in the level district. An average surface slope of the banks of Cayuga lake is perhaps 500 feet to the mile and the side slopes of all the valleys and other lakes is not very different. The effect is that all the tributaries are extremely rapid and torrential, washing down into the valleys pollution from fields and from the surface generally, often temporarily flooding the valleys when sufficient run-off capacity is not available. As an example, the conditions at Montour Falls, at the south end of Seneca lake, and at Ithaca, at the south end of Cayuga lake, may be cited. Both of these districts have been made the occasion of special reports by agents of the Department of Health and will be found in the published reports.

The velocity of the main streams in the side valleys being high and the surface wash being foul the conditions of pollution are ideal and the dangers to be apprehended from the main stream into which all the wash is carried are very great, provided any use is made of the main stream for domestic purposes. To offset these conditions, however, the fact exists that a large part of the drainage comes through one or more of the lakes where sedimentation is active and where a large part of the impurities are deposited. This mitigating circumstance is true not only of the surface wash but also of the sewage of the large cities. Thus

Syracuse discharges into Onondaga lake; Auburn, into a series of ponds used for power purposes; Ithaca, into Cayuga lake; Geneva, into Seneca lake; Rome, into Oneida lake; Canandaigua, Seneca Falls, Waterloo, Lyons, Newark, Clyde, Baldwinsville and Fulton and Phœnix discharge directly into the main river and it is the pollution from these cities and villages which is most to be feared. The efficiency of sedimentation in removing *all* dangers from sewage polluted waters is questionable but there can be no doubt that it very much reduces the dangers from drinking such contaminated water.

Soil

Owing to the glacial deposits caused by the gradual withdrawal of the ice sheet from this watershed area, the soil covering of nearly all the district is a mixture of clay and gravel, with pockets of either, interspersed. Drift fills the valleys to great depths (containing less clay) although the general character of the soil throughout is indicated by the geological term, boulder clay. Little subsurface drainage of large extent can, therefore, be expected although in the valleys alongside the streams and rivers, subterranean water in large quantities is found.

The glacial soil is composed of the results of glacial erosion and of rock decay, such soils being even now in the process of formation. The soil is, therefore, strong, supplying steadily the necessary elements of plant fertility. The district in question is, therefore, as a direct result of the glacial formation of the soil constituents largely agricultural. The clay soils produce crops of apples and pears and grapes, the hillsides being particularly well adapted for the latter, and the valley bottoms are devoted to general agriculture.

The following table shows the percentage of area in the several counties of the watershed which, according to the United States census for 1900, are reported as farms, the improved and unimproved portions being shown in separate columns.

TABLE SHOWING THE AREAS OF THE SEVERAL COUNTIES ON THE OSWEGO RIVER WATERSHED AND THE AREAS OF IMPROVED AND UNIMPROVED FARMS WITH PERCENTAGES.

COUNTY.	AREA.		Total area of farms.	Per cent.	Area of improved farms.	Per cent.
	Square miles.	Acres.				
Cayuga	756	483,840	413,924	.85	341,950	.71
Madison	670	428,800	388,866	.91	232,647	.54
Oneida	1,215	777,600	657,748	.85	447,359	.57
Onondaga	812	519,680	453,934	.87	383,621	.74
Ontario	640	409,600	405,003	.99	318,948	.78
Oswego	1,038	664,320	492,935	.74	319,431	.48
Seneca	420	268,800	194,591	.72	169,186	.63
Schuyler	352	225,280	196,718	.87	158,991	.71
Tompkins	506	323,840	285,721	.88	230,543	.71
Wayne	624	399,360	363,211	.91	305,299	.77
Yates	320	204,800	203,568	.99	168,485	.82

The watershed area, therefore, as a whole is agricultural and is likely to remain so, with the probability that with more intensive cultivation the pollution of the streams from wash of fertilizer will increase rather than decrease.

Area of Water Surface

The lakes, in spite of their large influence on the run-off and of the pollution have only a small percentage of the area, a total area of lake water surface being 295 square miles as compared with the total area of 5,013 miles or about 6 per cent. The drainage area tributary to these lakes is, however, large, 4,564 square miles out of the total area, or 89 per cent. This emphasizes the importance of the sedimentation process carried on in the lakes and the relatively small area over which immediate and careful supervision is necessary, namely, that area and those cities and villages which do not drain into the lakes but directly pollute the main river, mentioned on page 585 of this report. The following table gives the details of the areas on the several lakes and tributary thereto.

TABLE SHOWING THE AREAS OF THE LAKE SURFACE AND OF THE SURFACE AREAS TRIBUTARY THERETO ON THE OSWEGO RIVER WATERSHED.

NAME.	Lake area. sq. m.	Lake area tributary. sq. m.
Oneida	80.9	**1,300**
Cazenovia	2.8	**9**
Seneca	66.0	**707**
Keuka	20.3	**187**
Cayuga	66.7	**593**
Canandaigua	18.6	**175**
Owasco	12.4	**208**
Skaneateles	15.1	**84**
Onondaga	4.1	**267**
Otisco	4.0	**34**
Cross	3.9	......
	294.8	**4,564**

The character of the soil, indicating the probable amount of subsoil drainage and surface wash, can be estimated on the level district where the work was done by the borings made by the authorities of the barge canal survey. Along the line of this proposed canal, which is approximately on the present location, 39,200 lineal vertical feet of borings were made, the average depth being 14.8 feet. Of this distance 23 per cent. was in sand, 16 per cent. in clay, 13 per cent in sand and gravel; and 12 per cent. in sand and clay. The remaining 36 per cent. was divided among hardpan, clay and gravel, muck, etc., as shown in the following table.

TABLE SHOWING DEPTHS OF MATERIAL OF VARIOUS SORTS ALONG THE LINE OF THE BARGE CANAL FROM LITTLE FALLS TO ROCHESTER.

MATERIAL.	Vertical feet.	Per cent.
Sand	8,918	**23**
Clay	6,514	**16**

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MATERIAL.	Vertical feet.	Per cent.
Sand and gravel	4,996	13
Sand and clay	4,576	12
Gravel and clay	3,674	9
Gravel	3,237	8
Sand, clay and gravel	2,726	7
Muck and quicksand	2,732	7
Hardpan	1,545	4
Rock	282	1
	39,200	100

Population

The density of population on this watershed, while not generally dependent on the population concentrated in large cities, yet is so grouped in frequent villages and in well-developed farming communities that the density of population is above the average of the whole State. This, the State Water Supply Commission gives as fifty per square mile excluding the cities and large villages. The total population of this watershed is about 490,000 which means on an area of 5,013 square miles a density of ninety-eight per square mile. If the population of Syracuse, the largest city, be subtracted, the density becomes seventy-eight per square mile. The accompanying plan, plate III of the Report of the State Water Supply Commission, presents a comparison of densities with other parts of the State. This plan shows that in each county the presence of a city is indicated by an increased density. For example, in Niagara, Monroe, Onondaga counties, if the population of their largest city be subtracted, the density falls to fifty-five, eighty-five and seventy respectively instead of 152, 350, 220, as given, and the comparison might be extended to other counties where the density is apparently high.

Purity of water in streams depends directly on the paucity of population on the gathering ground and the effect of increased density is so well understood that chemists have considered that an increase of twenty persons per square mile would increase the chlorine in the surface water by 0.1 part per million, on account of the increased human pollution. Fifty to eighty persons per square mile is a small number, giving as an average to each person about eight acres on which to live and care for his wastes. The city of Boston gets an important part of its water supply from an area on which are over 700 persons per square mile and the supply is considered good. But in this case especial care is taken to prevent as far as may be the sewage of this population escaping anywhere on the watershed without first undergoing a thorough purification.

So far, however, as the density of population alone is concerned, and excluding the eight large cities on the watershed, the conditions are favorable not merely for retaining the Oswego river in its original purity but also for utilizing the stream as a source of drinking water if so desired, in so far as human contamination is concerned.

The cities on the watershed are few, only eight in number, and are the first eight of the following table. Rome discharges a portion of its sewage into the Mohawk river but this portion is only from the extreme easterly part of the city and is here estimated to be one-tenth of the entire city. The population of Rome is, therefore, reduced to one-tenth. The other names on the list are those of incorporated villages which either as a whole or in part discharge sewage directly into the stream.

Table Showing Population of Cities and Villages Having Partial or Complete Sewer Systems and Discharging into the Oswego River or its Tributaries.

Syracuse	117,498	Penn Yan	4,504
Auburn	31,423	Solvay	4,196
Oswego	22,199	Waterloo	4,123
Rome	14,906	Canastota	3,244
Ithaca	14,615	Baldwinsville	2,961
Geneva	12,250	Watkins	2,951
Fulton	8,848	Clyde	2,552
Oneida	8,420	East Syracuse	2,509
Canandaigua	7,361	Clifton Springs	1,586
Seneca Falls	6,733	Groton	1,188
Lyons	4,758	Jordan	965
Newark	4,554		

Total population discharging sewage, 262,148.

TABLE SHOWING POPULATION OF INCORPORATED VILLAGES ON THE OSWEGO RIVER WATERSHED DRAINING INTO THE MAIN STREAM OR ITS TRIBUTARIES.

Fairport	2,849	Dryden	699
Camden	2,370	Cleveland	689
Palmyra	2,096	Victor	649
Cazenovia	1,819	Chittenango	639
Phœnix	1,532	Ovid	624
Weedsport	1,525	Aurora	623
Moravia	1,442	Macedon	592
Fayetteville	1,304	Marcellus	589
Phelps	1,306	Savannah	573
Dundee	1,291	Camillus	567
Trumansburg	1,225	Rushville	416
Manlius	1,219	Freeville	440
Montour Falls	1,193	Burdette	409
Hammondsport	1,169	Newfield	378
Liverpool	1,133	Vernon	380
Naples	1,048	Cato	350
Port Byron	1,013	Eastwood	341
Shortsville	922	Odessa	354
Union Springs	994	Meridian	335
Interlaken	717	Oneida Castle	291
Manchester	711		

Total population in incorporated villages without sewers is, therefore, 39,116.

The density of population on the rural areas can be found by subtracting the population of the cities and villages from the total population. If the population now with sewers are subtracted the remaining population becomes 227,852 and the resulting rural density is forty-five per square mile. If the population in all cities and incorporated villages on the watershed be subtracted from the total population the remaining population becomes thirty-eight per square mile. About 62 per cent., therefore, of the total population live in the cities and incorporated villages and the remaining 38 per cent. are scattered on the farms and in the hamlets on the watershed.

It may also be noted that of the twenty-two cities and villages noted in the table on page 589, all of the first eight named have complete sewerage systems and discharge raw sewage directly into the main stream or its tributaries. The population of these eight is 215,324, or nearly one-half of the entire population on the watershed. It is also 71 per cent. of the entire population resident in all the cities and incorporated villages on the watershed. If, therefore, these eight cities should properly purify their sewage before discharging it into the stream 71 per cent. of the sewage of the entire district would be properly treated.

Stream Flow

The flow in the Oswego river is unusually uniform, due undoubtedly to the large area of swamp and water surface. For the four years, 1901 to 1904, inclusive, at Minetto, the monthly average varied from a minimum of 2,813 cubic feet per second to a maximum of 18,721 cubic feet per second, a condition of great regularity compared with other streams with similar torrential tributaries. In 1899 and 1900, however, the flow during the summer months was much reduced, being less than 1,000 cubic feet per second during all the summer months for both years, reaching an extreme minimum of 585 cubic feet per second in October, 1899. The details are shown in the appendix of preliminary report. The flow of 585 cubic feet per second is at the rate of eleven hundredths cubic feet per second per square mile of watershed, a low value for so large an area. It may be accounted for, in part at least, by the fact that a large amount of the natural drainage is intercepted by the Erie canal and is thus prevented from following the stream to the outlet. The general statement is made in the report on the barge canal that low water flow in the Oswego is at the rate of twenty-three hundredths cubic feet per second or a total of 1,150 cubic feet per second. Taking these two values for the probable minimum flows on the different parts of the watershed where no actual measurements of the flow have been made, the minimum flow at the several points named have been computed and are shown in the following table:

TABLE SHOWING THE PROBABLE MINIMUM FLOW IN DIFFERENT PARTS OF THE OSWEGO RIVER WATERSHED, COMPUTED FROM THE AREAS ASSUMING MINIMUM FLOWS OF 0.11 AND 0.23 CUBIC FEET PER SECOND PER SQUARE MILE FOR THE AREA DRAINED.

LOCATION.	Drainage area in square miles.	Discharge, 0.11 cubic feet per second per square mile.	Discharge, 0.23 cubic feet per second per square mile.
		Cu. ft. per sec.	*Cu. ft. per sec.*
Minetto	5,013	550	1,150
Oneida outlet	1,300	143	329
Onondaga outlet	301	33	67
Otisco outlet	34	4	8
Skaneateles outlet	84	9	19
Owasco outlet	208	23	48
Cayuga outlet	593	65	136
Seneca and Keuka lakes	894	98	206
Canandaigua	175	19	40
Three River Point	3,432	377	789
Baldwinsville	3,103	341	713
Canandaigua creek at Lyons	431	47	99
Ganargua at Lyons	298	33	68
Clyde at Lyons	729	80	167

The pollution of the Oswego river and its tributaries that is most to be apprehended comes from the discharge of sewage. No sewer gaugings are available and estimates must be based on the tributary population. This may be done by assuming a per capita consumption of water and considering that the water consumption and the sewage flow are the same. The pollution is then expressed as the ratio of the stream flow to the sewage flow. The population may also be directly referred to the stream flow, expressing the ratio of stream flow if cubic feet per second to the population expressed in thousands. For example, at Minetto, for a minimum flow of 585 cubic feet per second the pollution may be computed as follows, assuming all the cities and villages to be sewered and to discharge directly into the stream, and assuming a per capita water consumption of 100 gallons per day.

$$\frac{301{,}264 \times 100}{60 \times 60 \times 24 \times 7.5} \text{ is 46 cubic feet per second.}$$

If only the eight cities now having sewer systems and discharging sewage actually into the river be considered, the computation is

$$\frac{262{,}148 \times 100}{60 \times 60 \times 24 \times 7.5} \text{ or 38 cubic feet per second.}$$

If in the first case, one-tenth of the remaining population in villages be supposed to contaminate the stream, the value forty-six is changed to fifty-two and in the second case to forty-six. The flow of sewage may, therefore, be taken as from fifty-two to forty-six cubic feet per second and the minimum flow of the stream by the table on page 592 at from 550 to 1,150 cubic feet per second. The dillution is, therefore, from twelve to twenty-three times. It is generally understood that it is necessary to have a dilution of from twenty-five to forty times in order to have a satisfactory result, that is so that the mixture shall not at any time become outwardly offensive. It is not possible to place any dilution as that which will prevent distribution of disease of the polluted water is used for drinking water. The dilution of forty times is that necessary to avoid all nuisances of smell and appearance. The flow of the Chicago Drainage canal was adjusted entirely with a view to securing this dilution.

Again, sanitarians agree that a flow of about four cubic feet per second will properly dilute without creating a nuisance the sewage from 1,000 persons. Two hundred and sixty-two thousand one hundred and forty-eight persons would, therefore, require a stream flow, of 262 x 4 or 948 cubic feet per second which is the average minimum flow of the stream but nearly twice the actual occasional minimum. This indicates that the river is barely able to assimilate the pollution and that local pollution will undoubtedly result and that a generally unsatisfactory condition of the river in its lower reaches must inevitably result in the near future.

Considering now the several parts of the watershed by themselves, taking them in order up stream, we find the relations between the stream flow and the sewage flow to be as follows:

ONEIDA LAKE to its outlet has a minimum flow of from **143 to** 349 cubic feet per second and a total population on **the watershed** of 66,450 persons. There are two cities, Rome and Oneida, and the following villages on the watershed, viz., Cazenovia, Canastota, Camden, Oneida Castle, Chittenango, East Syracuse, Cleveland and Vernon. This means a total population now discharging sewage of 29,079 and a future total population in villages and cities of 35,267. At 100 gallons per head per day, this reduces to 5.4 cubic feet per second for the flow of sewage as compared with the stream flow of 143 to 349 cubic feet per second or a dilution of from twenty-six to sixty-three times, which is satisfactory and reasonable and not likely to cause any nuisance. It does not imply anything, however, as to the possibility of local pollution in Wood creek at the point where the sewage of Rome is received. Here the creek is much overtaxed and some method of preventing the deposit of the gross impurities into the stream should be devised and put in operation.

ONONDAGA LAKE has a minimum stream flow at its outlet of from thirty-three to sixty-seven cubic feet per second, and has a total population on the watershed of 134,208, of which Syracuse has 108,374, Solvay, 4,196, and the remainder is rural and resident in the villages of Eastwood, Liverpool, Marcellus, Camillus, the four villages containing 2,630 persons. Taking the total sewered population as the sum of the population of Syracuse and the five villages or 115,200, the flow is eighteen cubic feet per second which compared with the minimum stream flow shows a dilution of but from two to four times. The actual minimum flow from Onondaga lake is probably more than the watershed area would indicate because it is commonly understood that a large part of the flow is due to the presence of springs at the bottom of the lake. The otherwise inevitable nuisance is probably avoided by the large quantity of chemicals (calcium chloride) discharged into the lake by the Solvay Company. In spite of the springs and in spite of the large sedimentation occurring in the lake, the outlet is badly polluted, the chemical analysis of the water at Long Branch, which is on this outlet, clearly proving the fact.

SKANEATELES LAKE has a watershed area of eighty-four square miles and should have a minimum stream flow in its outlet of from nine to nineteen cubic feet per second. On the watershed are no large cities and but two villages, Jordan, with a population of 965, and Skaneateles village, population of 1,495, or 2,460 in both. This indicates a sewage flow of less than one-half of one cubic foot per second sewage flow, which compared with the stream flow means a dilution of from twenty-four to forty-nine times which is satisfactory and reasonable and not likely to cause any nuisance.

OWASCO LAKE has a minimum flow of from twenty-three to forty-eight cubic feet per second, and it is probable that in time of low water the mill ponds store up water during certain times of the day and thus leave the stream practically bare. The city of Auburn and the villages of Groton, Moravia and Port Byron are on this watershed and have a combined population of 35,066 or the sewage has a probable flow of five and six-tenths cubic feet per second, or a dilution when compared with the stream flow of from four to nine times. This undesirable condition is aggravated by the fact that among the industries in Auburn which discharge their trade wastes into the stream are some handling wool the refuse from which is particularly troublesome in stream pollution. The dilution is entirely inadequate, the condition of the stream offensive and the city of Auburn a gross offender against the purity of the stream and the main river into which it discharges. For a concise summary of the conditions reference is hereby made to a report by Mr. O. H. Landreth to the State Department of Health, to be found on page 188 et seq., of the report for 1903.

CAYUGA LAKE has a minimum flow at its outlet of from 65 to 136 cubic feet per second. On the watershed is the city of Ithaca, and the villages of Cayuga, Union Springs, Aurora, Interlaken, Trumansburg, Freeville, Dryden and Newfield, a total population of 19,691 or a probable future sewage flow of three cubic feet per second, which compared with the stream flow of 65 to 136 cubic feet per second indicates a dilution of from twenty-two to forty-five times. The chief pollution comes from the city of Ithaca, and the danger from this source is minimized by the fact that the length of the lake is available for sedimentation. Further, Ithaca now has under construction a purification for its sewage. The conditions at the Cayuga outlet are, therefore, satisfactory and not calculated to produce a nuisance.

SENECA RIVER is the outlet of the Seneca and Keuka lakes and has a minimum flow of 98 to 206 cubic feet per second. On the watershed are the villages of Seneca Falls, Waterloo, Watkins, Burdette, Montour Falls, Odessa, Hammondsport, Dundee, Ovid, Penn Yan and the city of Geneva. The total population is 36,766 or a probable future sewage flow of five and seven-tenths cubic feet per second, which comparing with the stream flow gives a dilution of from eighteen to thirty-seven times. This dilution is reasonable and satisfactory in view of the fact that the sewage of Geneva is subjected to sedimentation in the lake, and only the two villages of Seneca Falls and Waterloo discharge raw sewage directly into the river, all the remaining villages discharging into one of the two lakes. The woolen factories at Seneca Falls and Waterloo may cause local contamination of the stream and in the future it may be necessary to restrict the discharge from those two villages but except for local contamination, there seems to be nothing to be apprehended from Seneca lake.

CANANDAIGUA OUTLET discharges the overflow from Canandaigua lake into the Clyde river at Lyons and has a minimum flow of from forty-seven to ninety-nine cubic feet per second. On the watershed are the villages of Canandaigua, Phelps, Clifton Springs, Manchester, Shortsville, Rushville and Naples, a total population of 11,724 or a probable future sewage flow of one and eight-tenths cubic feet per second. Comparing this with the stream flow, the dilution is from twenty-six to fifty-five, which is apparently a satisfactory dilution. Conditions are made abnormal, however, by the fact that during the time of low water in the lake, and when the level of the lake has begun to fall, flash boards are used on the dam which regulates the lake level and the elevation increased so that navigation on the lake may be improved. It is stated that on this account it often happens that the stream flow in the outlet, especially above the entrance of Flint creek, is reduced to nearly nothing. There has been in the past, without doubt, local pollution in this part of the stream and the cities on this outlet below the village of Canandaigua have and with reason complained bitterly of the pollution caused apparently by the Canandaigua sewage. The Canandaigua authorities have now taken up the matter of the construction of a disposal plant for their sewage and it is likely that this source of local pollution will be stopped in the near future.

GANARGUA CREEK is the upper end of the main river and at Lyons where it combines with the Canandaigua outlet has a minimum flow of from thirty-three to sixty-eight cubic feet per second. On this branch are the villages of Newark, Palmyra, Victor, Fairport and Macedon, having a population of 10,731 or a sewage flow of one and seven-tenths cubic feet per second. Comparing this with the minimum stream flow, there is a dilution of from nineteen to forty, which indicates that the danger from a nuisance being caused in this part of the stream is very small, and that no danger of a nuisance is to be apprehended in this part of the stream.

On the main stream, not heretofore included, are the city of Fulton and the villages of Baldwinsville, Phœnix, Clyde, Lyons, Weedsport, Savannah, Meridian and Cato, with a total population of 23,434, the sewage from whom is carried with only the slight sedimentation from the mill ponds at Baldwinsville and below Three River Point directly to the Oswego water supply.

The results of the investigations of the preceding pages show clearly enough, even with the approximations necessary, that there is but a small margin between the present volume of the stream at the time of its minimum flow and the probable volume of the sewage of the cities and villages now on the banks and without assuming that any of these cities and villages increase their population. With any increase of population over that now resident, there would apparently be danger of creating nuisances in the stream by the mere fact of such discharge. The comparisons have been made as if the sewage from all the villages were concentrated at one point and there discharged. Practically, the diversion of the discharge, scattered as it is for a distance of 100 miles, reduces the danger of local pollution, and offers a greater opportunity for sedimentation by spreading the sewage flow over a greater area, but the diversion does not eliminate the danger. The amount of dissolved oxygen in the waters is apparently large in the winter as shown by the chemical analyses made, showing that the water has naturally large powers of assimilation and it is to this fact undoubtedly that there has been no general complaint made of the unsanitary condition of the river. Up to a certain point, the amount of dissolved oxygen is able successfully to nitrify the organic matter. Beyond this point, a nuisance is inevitable. In the Canandaigua outlet, where the dilution is apparently from twenty to forty times the artificial ponding in the lake at low water seasons, a local nuisance has been directly observed.

In the Owasco outlet, where the dilution is apparently from four to nine times, a serious nuisance is almost constantly maintained. At Port Byron, where the village takes its water supply, the conditions are revolting in the extreme.

In the lower end of the Seneca outlet, there is local pollution, which, while not yet serious, requires attention to prevent future difficulty.

The outlet from Onondaga lake, as well as the waters of the lake itself, are seriously polluted by the drainage from Syracuse.

Just above Oswego where the dilution is from twelve to twenty-three times and the conditions particularly menacing on account of the Oswego water supply, which comes from the river and is delivered to the city without purification, the matter of the pollution is so serious as to deserve immediate attention. Fortunately, Oswego is the only city on the watershed where the health of the residents are in immediate and constant danger from the condition of their water supply. Port Byron has a grossly polluted supply, but it is so well understood that no one uses it. The other places taking water for drinking purposes from the surface supplies on the watershed are Syracuse, Auburn, Geneva, Penn Yan and Canandaigua, all depending on sedimentation in the large lakes to keep the water pure. Syracuse, Auburn and Penn Yan have water rules which probably will keep their supplies good, although villages at the south end of Owasco and Seneca lakes discharge sewage directly into the lake. Oswego has suffered from the effect of sewage in its drinking water as the following plate will show. A reasonable typhoid fever death rate per 100,000 is, for surface supplies, from fifteen to twenty, a death rate which Oswego had, except for the year 1893, until Fulton built its sewers in 1896. Since that time the typhoid fever death rate has gradually but certainly increased, fluctuating with the amount of typhoid fever in Fulton probably as well as with (in inverse order) the flow of the river. In 1901 and 1902, for example, when the rainfall and stream flow were low, the ample sedimentation behind the dams settled out most of the dangerous germs.' The years since then have seen rapid increase in deaths from that cause in Oswego. It is possible that in the course of years, Oswego will secure a new supply from the waters of Lake Ontario, but this will apparently not be possible for some years and it will cost the city of Oswego many lives before that time if the present conditions continue.

There are, therefore, in my opinion, unquestionably two definite and distinct lines of policy to pursue:

The general policy should be adopted that all cities and villages, draining directly into the Oswego river, into the Seneca river and in to the Clyde river be required to build and maintain sewage purification plants in connection with their sewerage systems as far and as fast as they are completed.

The general policy should be adopted that all cities and villages draining into the lakes on the watershed should be required to construct and maintain in connection with their sewerage systems some sort of preliminary treatment by means of which the solids and grosser impurities would be kept out of those lakes.

It should further be understood that where special conditions made local pollution possible or probable, special means to prevent such pollution would be required by the Department. Such cases of local pollution now occur at Syracuse and at Auburn and might occur at Geneva and at Ithaca if those cities increase in size.

Appended herewith are two tables showing chemical analyses of the waters of Oswego river and its main tributaries taken at two different times. The sampling stations were selected to show the chemical quality of the water and the relative amounts of pollution of these streams at principal points, the analyses being made by the Division of Hygienic Laboratory, H. D. Pease, M.D., director. Table I gives analyses of samples collected February 28, 1907, and Table II similar analyses for samples collected March 13 to 16, 1907.

Respectfully submitted,

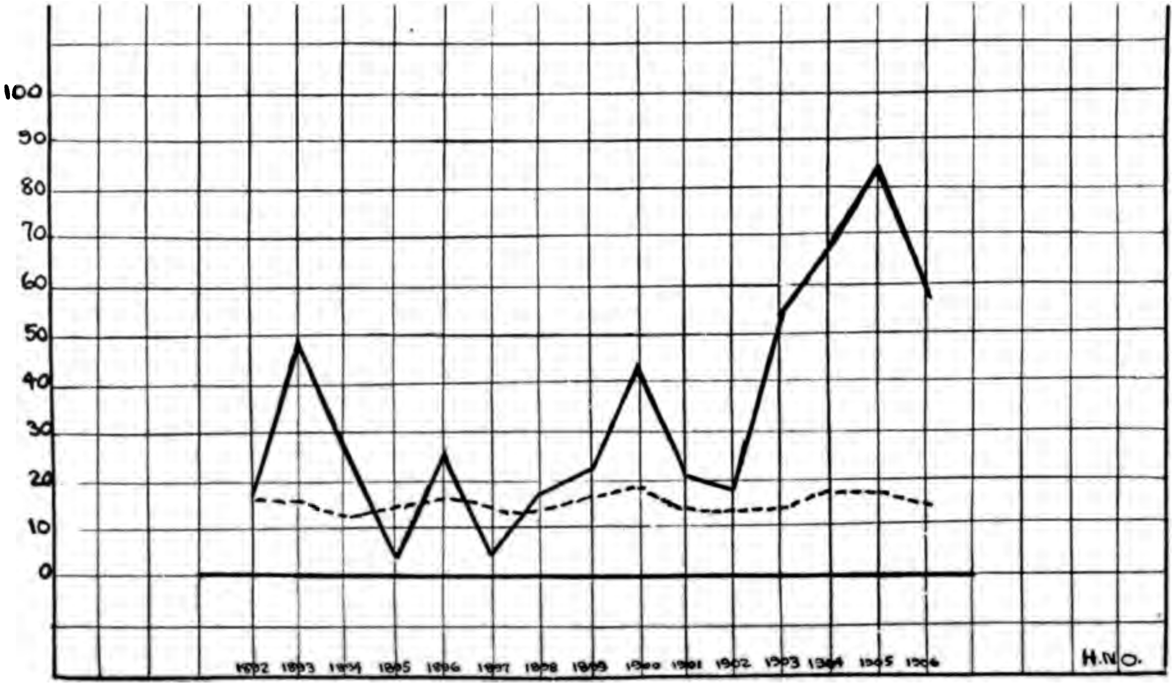
H. N. OGDEN,

Special Assistant Engineer

DEATH RATES AT OSWEGO, N. Y.

The full line shows deaths per 100,000 from Typhoid Fever.

The broken line shows deaths per 1,000 from all causes.



APPENDIX

Chemical Analyses of Water of Oswego River at Various Points Stated Below on February 26, 1907, and March 13–16, 1907.

Location of Points of Collection of Samples

No. 1. Ganargua creek.
No. 2. Canandaigua outlet.
No. 3. Clyde.
No. 4. Cayuga.
No. 5. Seneca river at Port Byron.
No. 6. Owasco outlet at Port Byron.
No. 7. Onondaga, Long Branch.
No. 8. Baldwinsville.
No. 9. Oswego.

TABLE No. I

(Samples collected February 26, 1907.)

SOURCE OF SAMPLE.	1	2	3	4	5	6	7	8	9
Nitrogen as free NH_3....	.086	.032	.026	.036	.046	.044	.560	.044	.035
Nitrogen as albuminoid NH_3..............	.180	.094	.140	.130	.134	.180	.280	.168	.092
Nitrogen as nitrites.....	.005	.025	.003	.020	.018	.018	.025	.018	.003
Nitrogen as nitrates.....	1.20	.720	1.000	.280	.400	.600	.480	.120	.020
Chlorine..............	6.	5.	10.0	52.0	38.	2.5	650.	30.	60.
Oxygen consumed......	4.00	2.10	3.10	1.30	2.00	200.	3.70	2.40	4.50
Turbidity............	8.	4.	5.	4.	6.	3.	6.	5.	4.

TABLE No. II

(Samples collected March 13–16, 1907.)

SAMPLE NUMBER.	1	2	3	4	5	6	7	8	9
Nitrogen as free NH_3...	.086	.130	.114	.170	.106	.260	.620	.086	.046
Nitrogen as albuminoid NH_3..............	.204	.330	.400	.490	.168	.264	.270	.158	.136
Nitrogen as nitrites.....	.003	.004	.018	.010	.010	.005	.040	.015	.004
Nitrogen as nitrates.....	.500	.000	0.10	.240	.400	.000	.500	.340	.240
Chlorine..............	3.5	2.0	3.0	14.0	32.0	3.00	615.	28.0	62.5
Oxygen consumed......	8.0	7.3	10.	11.4	4.2	5.7	3.6	3.4	6.2
Turbidity............	20.	30.	40.	60.	15.	25.	3.0	4.0	8.

Upon the completion of this investigation and the report, copies of the following letter were sent to the local authorities of all municipalities of the Oswego river watershed:

ALBANY, N. Y., *June* 14, 1907.

DEAR SIR:— In view of the increasing dangers to the public health of the cities and villages of the Oswego river watershed resulting from the discharge of sewage from these municipalities into the Oswego river, I beg to outline to you the policy which it is the purpose of this Department to pursue in the future to the end that this pollution may be prevented and ultimately eliminated.

In order to determine the nature and amount of this pollution and to study the effect which it has had upon the health of the municipalities situated along the river, a comprehensive sanitary investigation of the entire watershed was recently undertaken by the sanitary engineering division of this Department. This investigation covered a field examination of the principal sources of pollution, and included a statistical detailed summary of the population residing upon the drainage area of the Oswego river and its main tributaries; the population contributing sewage to these streams; the principal sources of manufacturing and industrial pollution; the relation of the volume of sewage pollution to stream flow; and the effects which this pollution has in the creating of general and local nuisances and upon the public health of persons or communities residing on or near the banks of these streams.

The work of the investigation is now completed, and the report which has been submitted to me clearly indicates that, if the public health of this section of the State is to be conserved, aggressive action must be taken at once not only to prevent the further discharge of untreated sewage into the waters of the Oswego river, but to eliminate the present sewage now being unlawfully discharged by many municipalities into these waters. The health of many municipalities has already suffered from the effects of the domestic and other wastes discharged into these waters, and unless this pollution is checked commensurate with the increasing population of the district, these deleterious effects will continue to be a menace to these communities.

To the end then that these dangers may be eliminated, and that the waters of the Oswego river may, as far as is practicable, be returned in their original purity, this Department will hereafter require that no sewage shall be discharged into any of the waters of the Oswego river without preliminary treatment. This requirement of preliminary treatment is in accordance with section 75 of the Public Health Law. The degree of purification required by this Department will depend upon local and other conditions affecting the public health and comfort of residents who dwell in the vicinity of these streams, or receive their water supplies from them, but will, in general, be as follows:

1. In the case of persons, corporations or municipalities situated on lakes of the Oswego watershed, not used for public water supplies, no sewage shall be allowed to enter such lakes without being first purified to such a degree that all solid and suspended matter will be removed, and that no odors or other offense shall be created in the vicinity of the points of sewage discharge.

2. In the case of persons, corporations or municipalities situated upon the Oswego river, and the main branches which form outlets to the lakes of the Oswego watershed, and upon all lakes used as a source of public water supply, no sewage shall be allowed to enter such waters without being first treated by a complete process of purification, the effluent from which shall at all times be free from all suspended matter and any dissolved or other organic matter that may undergo subsequent putrefaction.

The above outline of the general policy of the Department is offered as a guide to local authorities of municipalities, owners of manufacturing or industrial establishments, and private individuals, having at present or in contemplation, public or private sewerage systems that may drain into any of the waters of the Oswego river, and to indicate to them in a general way, the conditions upon which plans for such systems will be approved, and permits for the discharge of sewage thereof issued. It is expected that local conditions may alter these requirements with respect to the manner of sewage discharge, and to the degree of purity of the effluent from the sewage disposal works. It is also expected that with the future growth of population upon the watershed and the resulting increase of sewage that will have to be cared for, the requirements for more complete methods o posal and for greater purity of effluents may be demanded.

I beg, therefore, to call your attention to article 5 of the I Health Law, which provides for the protection of public supplies and the prevention of pollution of streams of the and to ask your co-operation in the enforcement of these visions to the end that the cities and villages situated i Oswego river basin may be protected against the existing increasing dangers of sewage pollution of these waters. I further, to request that you keep me informed, from time to as to the progress made in introducing or extending imp sewerage in your city (or village) and in the installati sewage purification works.

Very respectfully yours,

EUGENE H. PORTER,

Commissioner of Hea

MOHAWK RIVER WATERSHED

ALBANY, N. Y., *October* 15, 19

E. H. PORTER, M.D., *State Commissioner of Health, Al N. Y.:*

DEAR SIR:— I have the honor to transmit herewith th companying report of Prof. H. N. Ogden, Special Assistan gineer, on the second of the series of investigations of water of the State, covering an examination of the pollution o waters of Mohawk river.

A similar investigation covering the pollution of the Hudson river and its tributaries was undertaken earlier i year under special order of the Governor, and was reported to you under date of August 1, 1907. These two investig thus cover that portion of the entire watershed of the H river which lies above tidal influence — an area embracing 8,000 square miles lying in the portion of the State most de populated and most important socially and industrially.

This investigation was undertaken and carried out in a m similar to that recorded in our report on the Oswego river.

accompanying report describes fully the sanitary conditions found to exist upon the Mohawk river watershed, and I beg to express my full concurrence in the conclusions and recommendations therein stated.

Respectfully yours,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *October* 15, 1907.

Mr. THEODORE HORTON, *Chief Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR:— In accordance with your directions I have the honor to submit the following report of an investigation of the pollution of the Mohawk river and its tributaries.

Historical

The development of the Mohawk valley is almost coincident with the settlement of New York State. Fort Schuyler, on the site of the present city of Albany, was built in 1614, although for the next century it was little more than a frontier trading post. Schenectady, settled in 1660 and a stockaded village of eighty houses in 1690, was entirely destroyed together with all the other settlements of the Mohawk and Delaware valleys in that year. From 1690, to about 1770, although the fort at Schenectady was rebuilt and the blockhouse at Oswego erected, the Mohawk valley was entirely in the hands of the Indians, many of whom lived in large and flourishing villages. From 1770 to 1783, the valley was the scene of repeated pillage and massacre.

Beginning with the bloody battle of Oriskany, fostered by the encouragement of the English with whom the resident Iroquois were allied, and roused to deepest fury by Sullivan's punitive expedition, the Indians repeatedly wiped out the frontier settlements, leaving both the Mohawk and Susquehanna valleys desolate. After 1784, however, peace was established and the natural resources of the valley have caused a rapid development. Whitestown, founded by Hugh White in December, 1784, as one historian expresses it, was the " first rose that blossomed in the wilderness of the Central and Western New York," and very soon a highway was opened and in constant use from Albany through to Lake Erie. Scores of families flocked into the region and clearings appeared and loghouses were built almost as by magic.

The Erie canal, inaugurated in 1793 by the construction of locks at Little Falls, was a wonderful factor in the development, small boats being able, even in 1796, to pass from Schenectady to Oneida lake without interruption. In 1808, negotiations were commenced for a canal from Albany to Lake Erie and in 1817 work was begun, culminating in 1825 in the triumphant passage of the barge, Seneca Chief, through the completed canal. To the canal, and to the wisdom and sagacity of De Witt Clinton, its untiring advocate, the State owes the wonderful growth in wealth and population along the Mohawk valley for which that work is largely responsible. When built, the greater portion of the country through which it passed was uncultivated wilderness. Buffalo had a population of about 6,000. The first log cabin at Rochester was built in 1812 and the many thriving cities now existing along the line of the canal were then mere villages and forest settlements. But since these early days, along the canal, city after city has grown to great importance and, aside from the metropolis, there is to-day in the State no such concentration of population, wealth and material interests any where as in the Mohawk valley through which the canal runs.

The Mohawk river rises near the boundary line between Lewis and Oneida counties, about forty miles east of Lake Ontario and about twenty miles north of the city of Rome. It runs southerly to Rome and then turning easterly runs almost direct to the Hudson, a distance of about 100 miles, emptying into that river a little above Troy. There are two large tributaries on the north, known as East and West Canada creeks, both reaching well up into the Adirondack wilderness. On the south are also two large tributaries, Schoharie and Oriskany creeks, the former draining the northern and western slopes of the Catskill range and the latter joining the headwaters of the Chenango about twenty-five miles south of Rome. There are also small but important tributaries as follows:

North side: Six Mile creek, Nine Mile creek, Garoga creek, Cayadutta creek, North Chuctanunda creek. South side: Saquoit creek, Mud creek, Canajoharie creek, Flat creek, Chuctanunda creek, Oriskany creek.

The drainage area thus reaches east and west from Rome to the Hudson river, a distance of 100 miles, and from the Adirondacks on the north to the Catskills on the south, a distance of about ninety-five miles, the actual drainage area being 3,493 square miles.

The geological history of the Mohawk valley is extremely interesting. Chamberlain confidently asserts that before the glacial period, there was a divide at Little Falls, from which waters flowed westerly to Lake Ontario and easterly to the Hudson. Glacial erosion, however, cut through the rocky barrier and the old valley bottom was filled in from Rome by glacial debris. Faults in the rock at Hoffmans and at the Noses have also been eroded, making the deep gorges which now exist there. From Little Falls to Hoffmans and at the cutting, the river is but one-quarter mile wide. Strong bluffs border the river for several miles, but once through the rock, the valley becomes open. The upper valley, above Little Falls, is characterized by its glacial formation. Eight miles above Rome the river flows through a deep cut in shale rock, formed since the glacial period, and then meanders tortuously with little slope through what is undoubtedly glacial drift, deposited when the glacial stream discharged westerly. This portion of the river valley is, therefore, wide and is intersected by a number of small tributaries which find their way across the flat valley bottom. It is probable that a waterfall, 100 feet or more in height, formerly existed at Little Falls, now worn down to half that amount. The lower Mohawk valley is characterized by its great width, the main valley being in the form of beds or benches, which have apparently been deposited by earlier lake sedimentation. Through these deposits, the river has made its way, the total width of the entire valley being from twelve to twenty-five miles. Below Schenectady is another rock cut through which the river runs out by a shallow comparatively recent channel to the Hudson.

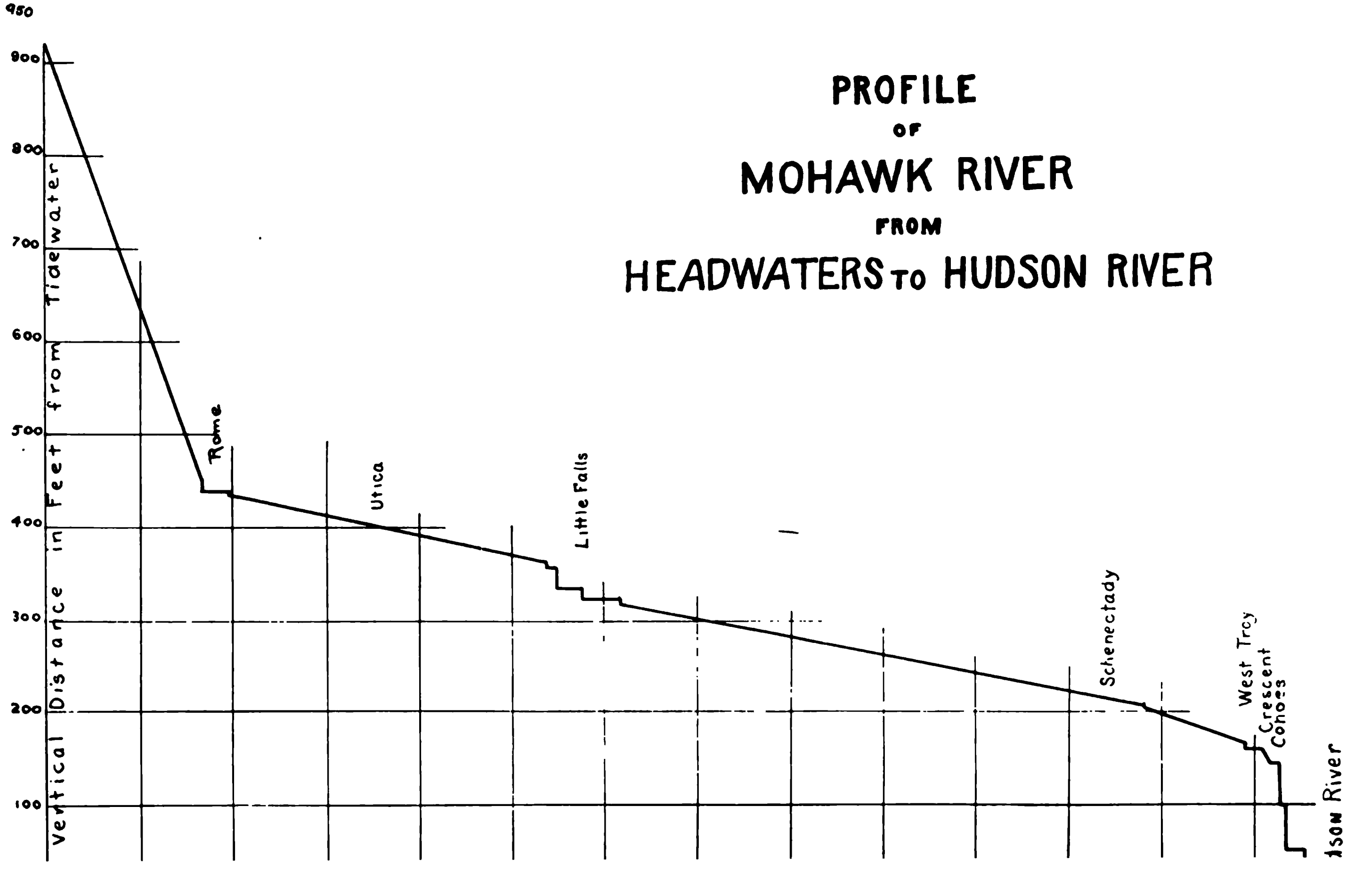
River Slopes

The river enters the Hudson from behind Peebles and Van Schaick's islands, the mean elevation of the Hudson below Troy being four feet above mean tide at Sandy Hook, and at the mouth of the Mohawk twelve feet, the difference being due to the State dam at Troy. This difference is utilized togther with additional fall in the channels west of the islands as a source of power so that the elevation just inside the river mouth is about fifty feet, rising to sixty at the foot of the Cohoes falls, about four miles away. The great fall at Cohoes with the aid of the dam at its summit increases the elevation to 156 and at Crescent, one and one-half miles above Cohoes, is a natural rapid making an elevation under the Mohawk aqueduct of the Erie canal of 162 feet.

Above the Crescent rapids is three miles of smooth water, extending to the dam of the West Troy water works, a structure about five feet high. Continuing up stream from this dam, the river has a sluggish flow, with occasional shoals and rocky banks, to Rexford Flats where a feeder dam for the canal has a height of six feet, bringing the water elevation above the dam to 208 feet above mean tide. From this dam to a point four and one-half miles below Little Falls, the river has a moderate slope broken by occasional riffles, the fall in the fifty-two miles being 108 feet or an average fall of two feet per mile. A State dam three feet high has been built at the upper end of this reach for the purpose of turning the river into the canal and the back water extends to the foot of the falls at Little Falls. Three dams exist here, the lower one of twelve feet, the middle one of nineteen feet and the upper one of four feet height, the elevation above Little Falls being 363. From Little Falls to Rome is a distance of about thirty-eight miles and the fall in the river is sixty-eight feet or nearly two feet per mile. The stream is sluggish and tortuous, flowing through flat alluvial meadows. At Rome is another low feeder dam for the canal and about three miles above Rome is a dam ten to twelve feet high, impounding water used for the Rome water supply. Above this the stream becomes torrential, the elevation at the point where the east and west branches unite, twenty miles above Rome, being about 910, or 475 feet above the water at Rome. The diagram shows the profile and slopes of the river from Troy to the junction of the east and west branches.

The slopes of the tributaries are generally steep, rising abruptly from the edge of the true Mohawk valley. On the south side

PROFILE
OF
# MOHAWK RIVER
FROM
HEADWATERS TO HUDSON RIVER



the Saquoit creek, which discharges just above Utica, rises about 130 feet in five miles to New Hartford, which is at the escarpment. In the next five miles the stream rises about 300 feet or sixty feet to a mile.

The Oriskany creek, which discharges at Oriskany village, rises about ninety feet in the first six miles, and in thirteen miles has reached an elevation of only 290 feet above its mouth. Beyond the point, however, the slope increases rapidly.

The South Chuctanunda creek has a flow of seven miles before it reaches the edge of the valley, rising 250 feet in that distance. In the next four miles it rises 400 feet or 100 feet per mile.

The Schoharie creek, the largest tributary on the south, occupies a subsidiary valley which has a comparatively gentle slope for many miles. At Central Bridge, twenty-four miles above the mouth, the elevation is only 140 feet above the Mohawk river, a slope of but six feet to the mile. At the head waters, however, it has an elevation of nearly half mile above the river.

On the north the conditions are similar. Nine Mile creek, between Rome and Utica, rises only 200 feet in the first eight miles. Beyond that point the water slopes are from sixty to eighty feet per mile. West Canada creek, the largest tributary on the north, discharges at Herkimer, rises 200 feet in the first ten miles and 360 feet in the first twenty-five miles. Then the falls and water power at Trenton Falls occur and in five miles the stream rises 400 feet. The Canada lakes, which are the head waters, have an elevation of about 2,350 feet, or about 2,300 feet above the mouth. East Canada creek, which discharges between St. Johnsville and Little Falls, rises 400 feet in the first seven miles. In the next two miles it rises over 100 feet and at twenty miles it has reached an elevation of 1,150 feet above the mouth.

The Cayadutta and the North Chuctanunda rise more rapidly, the former rising 450 feet in the first seven miles and the latter rising 400 feet in the first 3 miles.

But the general law of all the streams is the same, viz., that from the river to the edge of the original Mohawk valley the streams have a comparatively gentle slope, and that, once the side slopes of the valley are reached, the slopes increase.

Soils

As has been pointed out, the river bottom from Rome to Little Falls and again below Little Falls is chiefly glacial drift. Away from the flat, level, bottom lands the soils are heavy and compact, overlying the Utica shales and the Trenton limestone deposits. On the north side, the head waters of the Canada creeks lie in sand rock and granite formations. South of the valley bottom are shale formations interrupted by the Medina and Oneida sandstones and followed by the Niagara and Helderberg limestones and reaching finally the Catskill sandstones. The soils, therefore, like most of the limestone soils, are heavy and impermeable, and have the result of making the run-off rapid and heavy, especially where the modifying effect of forest cover is no longer experienced. At the head waters of the Canada creeks are numbers of small lakes, but except for these and the ponding caused by the dams on the river and its tributaries there is little water surface on the area except that due to the streams themselves. The area is largely deforested, and while some of the virgin woods remain in the Adirondack region and on the Catskill slopes the region is chiefly agricultural, the Schoharie creek country being famous for its butter and cheese industries.

The following table shows the percentage of area in the several counties of the watershed which, according to the United States Census of 1900, are reported as farms, the improved and unimproved portions being shown in separate columns:

	Area square miles.	Area acres.	Total area of farms.	Per cent.	Area of improved farms.	Per cent.
Fulton county	544	348,160	208,687	.60	115,213	.33
Greene county	686	439,040	337,909	.77	215,694	.50
Herkimer county	1,745	1,116,800	383,180	.34	272,158	.24
Montgomery county	399	255,360	236,934	.93	202,934	.79
Oneida county	1,215	777,600	657,748	.85	447,359	.58
Schoharie county	675	432,000	367,023	.85	283,225	.66

The following table from the same source gives additional data showing the general use of the watershed as a dairy region:

	Area.	Value of domestic animals.	Per acre.	No. of cattle.	Per square mile.
Fulton county	544	$793,795	2.28	13,933	.26
Greene county	686	1,240,566	2.82	19,025	.28
Herkimer county	1,745	2,411,903	2.16	51,617	.29
Montgomery county	399	1,541,673	6.04	27,423	.69
Oneida county	1,215	3,876,961	4.99	86,435	.71
Schoharie county	675	1,701,357	3.94	30,045	.44

In both the tables the effect of the Adirondack wilderness is seen in the counties of Fulton and Herkimer, about two-thirds of the latter county being in the Adirondack preserve. If the areas of these counties should be reduced by the amount of woodland contained, it is probable that they would show percentages of improved farms and of cattle equal to those of Oneida and Schoharie counties, since the character and use of the existing farms is much the same. The tables particularly show two things, viz., that about 67 per cent. of Fulton county, or 365 square miles, and 76 per cent. of Herkimer county, or 1,326 square miles, with smaller portions of the other counties, is still undeveloped and is largely wooded — perhaps 2,200 square miles out of the total area of 5,079 square miles — assuming that the watershed area is coextensive with the six counties named, not quite true. It further shows that the Schoharie creek drainage — 950 square miles — comes from areas which are practically cleared of forests. The flow, therefore, in the latter stream is irregular and erratic, having lower summer flows and higher flood flows than the Canada creeks, which come from the areas not yet cleared.

Population

The population in the valley bottom is high, although the total population on the entire watershed is moderate on account of the large uninhabited areas. The density of population in the six counties is given by the Water Supply Commission as follows:

County.	Total.	Per square mile.
Fulton	42,330	78
Greene	31,246	46
Herkimer	53,856	31
Montgomery	49,928	233
Oneida	139,347	115
Schoharie	25,273	37

Montgomery county is practically all in the valley bottom, Oneida contains several cities, while Greene, Herkimer and Schoharie show more nearly the actual rural population. The cities on the watershed follow the river very closely, and the following table gives their names and population according to State census of 1905:

Utica	62,934	Gloversville	18,672
Schenectady	58,387	Little Falls	11,122
Cohoes	24,183	Johnstown	9,845
Amsterdam	23,943	One-tenth of Rome	1,656
			210,742

The following incorporated villages are also on the watershed with population as shown:

Herkimer	6,596	Fultonville	912
Ilion	5,924	Hagaman	815
Green Island	4,878	Oriskany Falls	813
Waterford	1,234	Nelliston	709
Frankfort	2,870	Newport	672
Fort Plain	2,596	Middleville	597
Dolgeville	2,245	Richmondville	587
Canajoharie	2,224	Sharon Springs	526
St. Johnsville	2,172	Hunter	524
Scotia	2,166	Franklin	493
Cobleskill	2,158	Remsen	399
Whitesboro	2,018	Poland	366
Mohawk	2,044	Prospect	330
Waterville	1,510	Holland Patent	320
Clinton	1,315	Cold Brook	318
Middleburg	1,209	Palatine Bridge	318
Fonda	1,131	Trenton	317
New Hartford	1,043	Esperance	231
Schoharie	1,021		
			57,500

The following table shows the towns within the watershed area with their populations, exclusive of the cities and villages already given:

Ava (1/2)	353	Little Falls	718
Ashland	692	Litchfield (1/2)	465
Amsterdam	2,556	Marshall	1,566
Blenheim	768	Marcy	1,398
Ballston (1/5)	300	Manheim	841
Canajoharie	1,787	Minden	2,097
Clifton Park (1/2)	1,070	Mohawk	1,566
Charlton	1,109	Middleburg	1,603
Charlestown	1,052	Niskayuna	1,327
Conesville	793	New Hartford	4,223
Cobleskill	1,646	Newport	537
Carlisle	1,225	Norway	680
Deerfield	1,756	Ohio	660
Duanesburg (1/2)	1,214	Oppenheim	1,150
Esperance	806	Prattsville	775
Ephratah	1,566	Princeton (1/2)	347
Fairfield	1,390	Palatine	1,575
Frankfort	1,808	Paris	2,626
Floyd	785	Perth	667
Fonda	1,988	Root	1,653
Fulton	1,988	Russia	1,755
Gilboa	1,448	Rotterdam (1/3)	2,570
Glen	1,304	Richmondville	1,068
Garoga	470	St. Johnsville	801
Galway	1,350	Stratford	830
Glenville	3,010	Schoharie	1,694
German Flats	1,497	Seward	1,404
Herkimer	1,193	Sharon	1,491
Half Moon	200	Salisbury	1,426
Hunter	1,764	Schuyler	1,365
Jewett	1,028	Steuben (1/2)	451
Johnstown	2,661	Trenton	1,645
Kirkland	3,205	Vernon (1/3)	704
Lexington	1,153	Watervliet (1/2)	816

Waterford (1/2)	1,511	Western	1,621
Wright	1,155	Whitestown	4,277
Windham	1,387	Westmoreland	2,192
			103,582

Total in cities	210,742
Total in incorporated villages	57,500
Total in towns outside	103,582
	371,824

Area of watershed	3,493	sq. miles
Average density of population on watershed is	107	
Average density, omitting cities, is	47	
Average density, omitting cities and villages	29.6	

NOTE.—The fractions following the names of the towns show that only that portion is in the Mohawk valley watershed.

The greater part, viz., 58 per cent. of the population, therefore, is in the eight cities named above and if the incorporated villages directly on the Mohawk be added with their population of 13,884 the percentage of total population becomes 62 per cent. which is the percentage of the total population from whom the immediate pollution of the river is due. Not all the population is at present connected with sewers, even in the cities and villages where complete sewer systems have been built, but ultimately the population as above, viz., about 270,000, will more or less directly contaminate the stream with human wastes.

In order to ascertain the probable increase in population to be anticipated in the near future the diagrams have been prepared. Diagram I shows the growth in population by ten-year periods since 1840 of eight counties, included partially or entirely in the watershed, and the slope of the lines and of the average line shows clearly that the growth is likely to be small. Apparently in 100 years the growth would only be increased 50 per

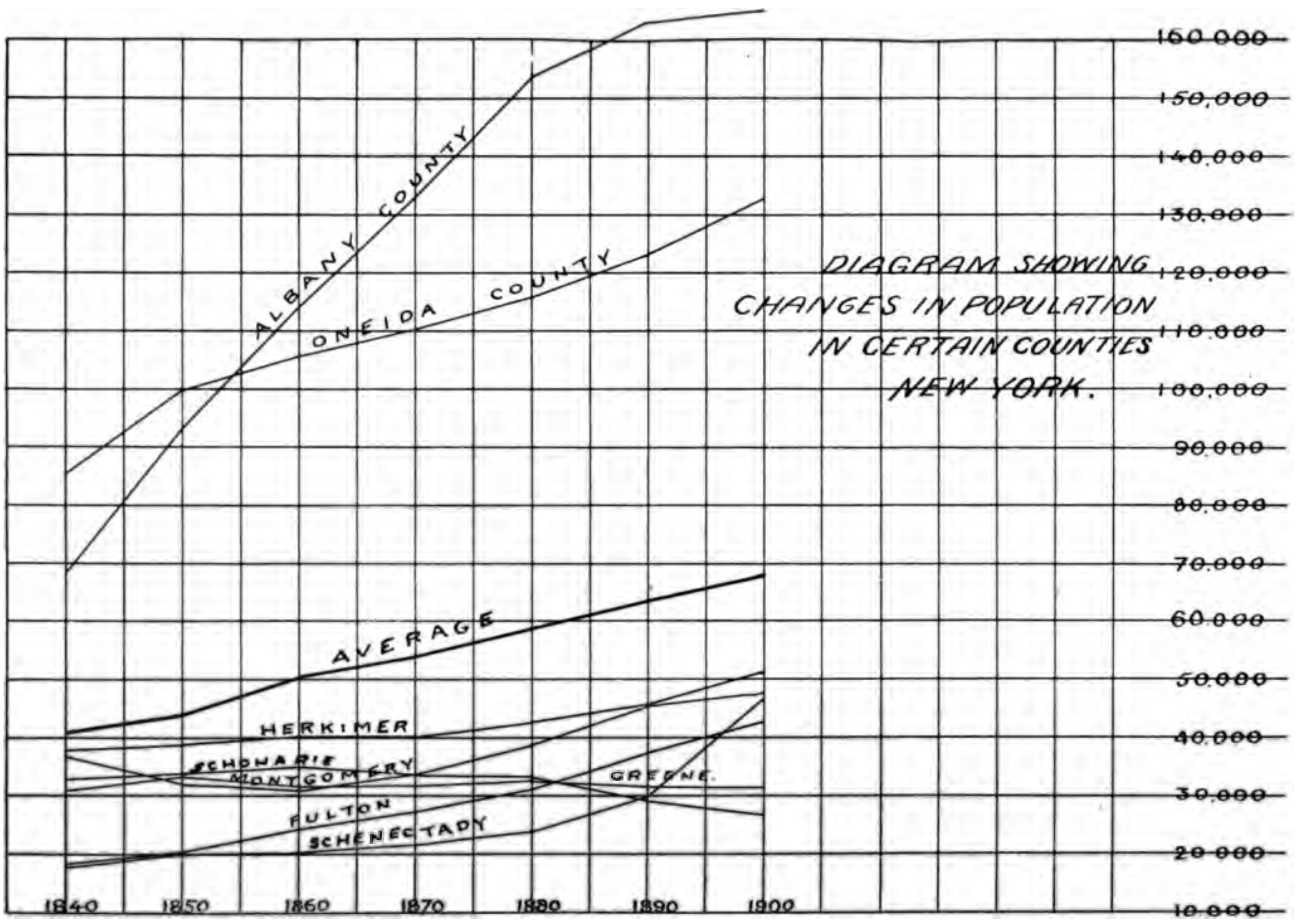


DIAGRAM SHOWING
CHANGES IN POPULATION
IN CERTAIN COUNTIES
NEW YORK.
ALBANY COUNTY
ONEIDA COUNTY
AVERAGE
HERKIMER
SCHOHARIE
MONTGOMERY
GREENE.
FULTON
SCHENECTADY
160,000
150,000
140,000
130,000
120,000
110,000
100,000
90,000
80,000
70,000
60,000
50,000
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1840
1850
1860
1870
1880
1890
1900

Diagram II.

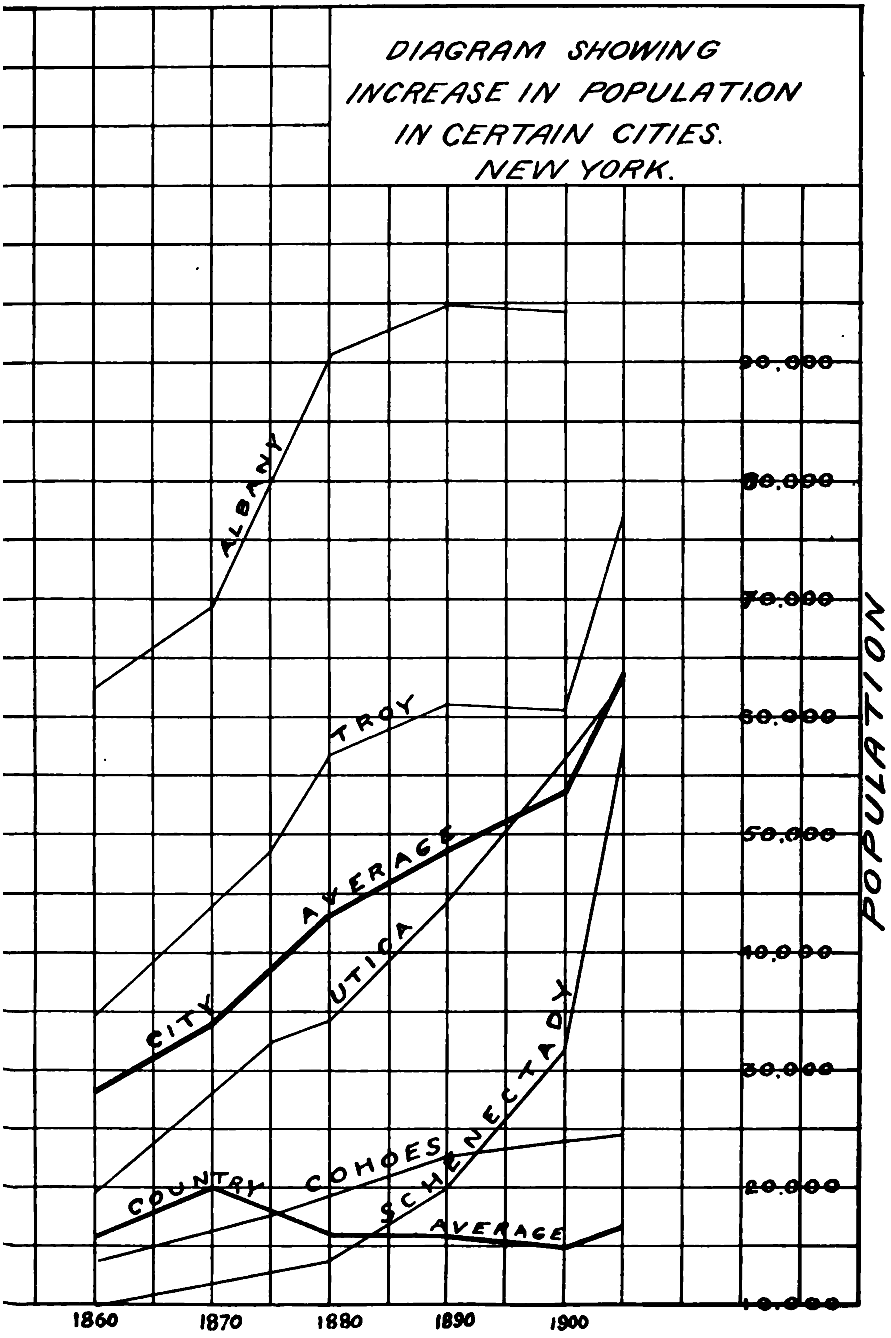


DIAGRAM SHOWING
INCREASE IN POPULATION
IN CERTAIN CITIES.
NEW YORK.
ALBANY
TROY
CITY AVERAGE
UTICA
SCHENECTADY
COHOES
COUNTRY AVERAGE
90.000
80.000
70.000
60.000
50.000
40.000
30.000
20.000
10.000
POPULATION
1860
1870
1880
1890
1900

cent., the average line changing from 68,000 in 1900 to about 90,000 in 2000.

Diagram II shows the rate of city growth as shown by five cities, the only ones in the watershed whose records are available. This shows a strong tendency toward urban increase, amounting apparently to about 75 per cent. in 100 years. This is not very definite and the rapid changes in Troy and Schenectady are suggestive of more rapid rates. The average city line deducted from the average county line, the figures for all the cities being taken, enables the "county average" line to be drawn which shows an apparent decrease in rural population, shown also in diagram I for Schoharie county, in which there are no large cities.

Stream Flow

The stream flow in the Mohawk valley has been made the subject of much investigation both by private interests and by public authority. The millowners at Cohoes have for many years kept records of the stream flow as affecting the development of power at that place. The studies made by the engineers for the barge canal included many measurements of the Mohawk flow and of its tributaries. The United States Geological Survey has maintained for several years gauging stations at a number of points between Troy and Rome. The conditions of flow are made very unusual by the abstraction of water both from the main river and from the tributaries for the use of the Erie canal which runs parallel to the river for the entire distance. Dams have been built across the river and streams and feeder channels dug at Rexfords Flats, Rocky Rift, Little Falls and at Rome on the Mohawk, on the Schoharie creek just above the mouth, on the Oriskany near the mouth, the latter artificially directing water from eighty-seven square miles on the upper branch of the Chenango. The drainage from 267 square miles of the Black river watershed is also led through the Black river canal feeder, discharging at Rome. The natural flow of the river must, therefore, be materially modified both by the amounts of water taken from the stream and by the amount brought into the canal from outside the watershed, some of which overflows into the Mohawk.

It is estimated that in the dry weather of summer the amounts withdrawn are as follows:

At Rexford Flats	250 cu. ft. per sec.
At Rocky Rift dam	220 cu. ft. per sec.
At Little Falls	150 cu. ft. per sec.
At Rome	50 cu. ft. per sec.
From Schoharie creek	35 cu. ft. per sec.
From Oriskany creek	90 cu. ft. per sec.
	845 cu. ft.

The Black River canal is estimated to supply 183 cubic feet per second directly to the canal.

Except that a considerable portion of this is lost by leakage and wastage, the amount would all be returned to the Hudson at the mouth of the Mohawk but it plainly must have a serious effect on the dry weather flow of the Mohawk.

Actual measurements of flow made are as follows:

At Dunsbach Ferry below all the feeders, the actual flow remaining in the river has been gauged to be in cubic feet per second.

	1898.	1899.	1900.	1901.	1902.	1903.	1904.
January	......	5,681	......	2,567	......	......	2,127
February	......	6,068	......	1,141	......	......	2,231
March	......	9,261	......	9,332	......	27,430	13,720
April	......	......	......	18,068	......	10,090	18,400
May	......	......	......	6,622	......	1,738	8,038
June	......	......	......	6,300	......	10,340	4,435
July	......	......	......	1,633	......	6,404	2,477
August	......	......	930	1,580	......	......	3,763
September	......	......	672	1,672	......	......	2,830
October	6,321	......	885	2,066	......	12,070	6,624
November	8,007	......	4,922	2,004	......	4,271	2,790
December	4,252	......	5,362	8,055	......	4,188	3,467

The effect of a dry summer is plainly seen by the low flow in August and September, 1900, when the flow from the watershed area of 3,440 square miles was about two-tenths cubic feet per second per square mile. If the flow of 672 cubic feet per second be compared with the total population on the watershed or 387,000, there is a flow of less than two cubic feet per second for 1,000 persons contributing sewage. Mr. Rafter gives the minimum flow for four days in September, 1900, as 373 cubic feet per second, about one cubic foot per second for each 1,000 persons, and in October of the same year the same minimum flow was recorded for two successive days. At Rexford Flats, nineteen miles up stream from the mouth, the following measurements have been made:

	Area 3,385 square miles.		
	1901.	1900.	1899.
January	2,822	7,860	5,739
February	1,299	9,032	3,935
March	9,221	4,235	9,004
April	16,701	14,996	17,057
May	6,345	2,857	4,084
June	6,668	1,503	2,014
July	1,830	1,447	498
August	1,320	1,746	294
September	1,995	981	980
October	1,059	784	1,608
November	2,090	8,440	2,824
December	6,931	6,056	7,001

The minimum flow shown is 294 for August, 1899. Mr. Rafter notes that in September, 1899, the minimum flow for fifteen days was only 228 cubic feet per second, followed by ten days with a rate of 278 cubic feet per second. These figures include the amount diverted into the Erie canal which accounts for the quantities being larger in many cases at the up-stream station. The contributing drainage area between the two stations is small and the tributary population is diminished by about 25,000, leaving a population of 362,000 or the minimum flow is at the rate of six-tenths cubic feet per second for each 1,000 contributing population.

The Geological Survey have maintained a gauging station at Schenectady for some time, the measurements of which should agree closely with those at Rexford Flats since no stream enters between and there is no withdrawal of water. The following table gives the results of those gaugings:

	Area 3,321 square miles.		
	1899.	1900.	1901.
January	......	....	3,079
February	4,792	....	1,577
March	9,659	....	6,141
April	11,941	10,726	13,311
May	5,715	3,526	6,761
June	1,140	1,336	6,133
July	1,040	1,005	1,532
August	534	866	1,951
September	1,133	609	1,957
October	......	896	2,099
November	......	3,621	2,008
December	......	5,614	4,947

The minimum flow in August, 1899, of 534 and of 609 in September, 1900, do not compare well with the minimum flows at Rexford Flats of 294 and 981 for the corresponding months.

At Fort Hunter, about forty-three miles from the mouth, Schoharie creek enters from the south. It has a drainage area of 947 square miles and comparing with the Mohawk might be supposed to have between 100–200 cubic feet per second as a minimum flow. Only a few gaugings have been made and those, at least as so far recorded, are not continuous through any year. The mean flow for August, 1899, was 142 cubic feet per second, although in the same month for 1901 the mean flow was 7,168 cubic feet per second. In July, 1900, the mean flow was 115 cubic feet per second and for three days during the month 76 cubic feet per second.

At Schoharie Falls, a few miles south of the mouth, a mean flow of thirty-two cubic feet per second was noted during September, 1900, the drainage area being 930 square miles. Fortunately there are no large cities on this stream, and it is evident that, in order to prevent objectionable contamination at certain times, extreme care must be exercised as to the amount of pollution.

At Fonda, forty-eight miles from the mouth of the Mohawk, the Cayadutta creek enters. This stream has a drainage area of sixty-two square miles and in August, 1899, had a mean flow of eighteen cubic feet per second; in September of the same year twenty and in October twenty-one cubic feet per second. It was only from fourteen to sixteen cubic feet per second, however, for several days during those months. The population of the two cities of Johnstown and Gloversville on this creek is about 28,500 or with fifteen cubic feet per second flow, about two cubic feet per second for each 1,000 population. The stream is plainly, therefore, not large enough to take care of the sewage flow, independently of the large amount of organic waste deposited by the manufactories on the stream, a discussion of which follows later.

At Little Falls some few measurements have been made, the drainage area being 1,337 square miles. The lowest records show a mean flow for August, 1899, of 223 cubic feet per second, not including the diversion to the Erie canal of about 150 cubic feet per second, a total of 373 cubic feet per second. For nine days, however, the measured flow was 120 cubic feet per second, or with the canal flow a total of 270 cubic feet per second, sufficient at the safe rate of five cubic feet per 1,000 population for 54,000 population, somewhat below the actual present population.

The following table shows actual measurements.

	1899.	1900.	1901.	1902.	1903.	1904.
January	2,753	5,523	1,741	......	2.309	1,525
February	1,510	3,862	1,125	......	3,777	2,447
March	3,757	2,469	4,754	......	10,980	5,914
April	8,102	8,142	7.061	......	4,323	8,336
May	2,651	2,063	2,874	......	922	3,987
June	1,014	801	3,290	......	2,912	1,972
July	803	943	1,124	......	1,778	1,343
August	223	694	1,167	......	2,541	2,033
September	298	630	1,171	......	1,116	2,009
October	509	899	1,472	......	4,643	3,405
November	1,699	3,854	1.600	......	1,862	1,150
December	3,360	3,240	3.970	......	1,662	1,511

East Canada creek enters the Mohawk from the north seventy-two miles from the mouth of the Mohawk and seven miles below Little Falls. The stream has a watershed of 256 square miles and is one of the most important branches so far as water supply is concerned. A large tributary, Fish creek, enters from the east about nine miles from the mouth, and a second tributary, Spruce creek, enters from the west about six miles from the Mohawk. The following measurements of the stream flow have been made at Dolgeville below the two main tributaries:

	1898.	1899.	1900.	1901.	1902.	1903.	1904.
January	....	816	531	235	......	666	169
February	....	439	879	248	......	971	217
March	....	519	276	691	......	3,041	758
April	....	1,978	2,086	2,094	......	1,241	2.343

	1898.	1899.	1900.	1901.	1902.	1903.	1904.
May	....	633	486	629	......	156	1,114
June	....	196	370	564	......	920	385
July	....	166	221	174	......	448	250
August	....	97	144	190	......	695	493
September	638	92	133	249	......	187	396
October	581	112	195	252	......	1,068	1,046
November	689	377	957	359	......	318	254
December	564	706	368	935	......	257	247

On account of the pondage in the lakes at the head of the Fish creek branch the minimum flow is much larger than on the other branches. For September, 1899, it was ninety-two cubic feet per second, and for eleven days of that month it was sixty-seven cubic feet per second or a minimum rate of twenty-six hundredths cubic feet per second per square mile. The population on the watershed is only 5,000, giving a minimum stream flow of thirteen cubic feet per second for each 1,000 persons, a very satisfactory dilution.

West Canada creek enters the Mohawk at Herkimer, and is, next to Schoharie creek, the most important tributary. It has its source in a series of lakes which tend toward uniformity in flow even during the dryest weather. The drainage area at the mouth is 569 square miles. It is proposed in connection with the present developments of the Erie canal to construct a large reservoir on this stream about twenty-five miles from the mouth from which water is to be supplied to the canal. Measurements have been made of the flow in this stream as follows:

	1898.	1899.	1900.
January	......	1,150	871
February	......	1,594	624
March	......	1,176	1,330
April	......	3,365	3,167
May	......	1,456	1,114
June	......	397	1,197
July	......	324	488
August	......	235	....
September	......	221	....
October	1,161	324	....
November	1,110	577	....
December	1,024	1,259	....

Gaugings have been taken at Middleville, area 519 square miles, the station being eight miles from the mouth. The minimum flow in September, 1899, was 221 cubic feet per second, but for several days the rate was 145 cubic feet per second and for eleven days was 183 cubic feet per second, or a rate of thirty-five hundredths cubic feet per square mile.

The flow is much greater per square mile than any of the other Mohawk tributaries and indicates the value of this stream as a water yielder. The population on this watershed is about 4,000 or the minimum stream flow is thirty-six cubic feet per second for each 1,000 persons, a very satisfactory dilution.

Oriskany creek enters the Mohawk river at Oriskany village about six miles above Utica. At Utica, the minimum flow in the Mohawk is stated to be for two days seventy cubic feet per second from a drainage area of 524 square miles. The figures are not very definite but with that flow the population above that point, including the city of Utica, would be contributing at the rate of less than one cubic foot per second for each 1,000 population.

Oriskany creek itself drains about 144 square miles, but in summer contributes but little water to the river since a State dam a few miles above the mouth diverts all of this water together with the water stored in six reservoirs on the head waters of the Chenango river, the drainage from 1043 acres of watershed, into the Erie canal.

The following measurements have been made of the flow in the Oriskany creek above the State dam:

	1898.	1899.	1900.
January	....	295	199
February	....	291	378
March	....	342	386
April	....	466	488
May	....	119	136
June	....	99	95
July	....	180	100
August	....	186	103
September	....	126	73
October	325	91	85
November	327	360	255
December	327	89	272

During the winter, when canal navigation is closed, the water flowing is the natural flow of the stream. This natural minimum flow was ninety-one cubic feet per second in December, 1899, but for ten days it was only fifty-four cubic feet per second. The population above the mouth is about 13,000, so that the minimum stream flow is at the rate of four cubic feet per second for each 1,000 population, a rate which will before long cause a nuisance.

At Ridge Mills the minimum flow recorded is for September, 1899, at the rate of eighty-one cubic feet per second for twenty-two days, while for three days the mean flow was fifty-six cubic feet per second. The population is only about 2,800 or the flow is at the rate of twenty cubic feet per second for each 1,000 population.

Factories

On account of the water power available there are on the Mohawk and its tributaries a number of factories which discharge large quantities of waste into the river. Their location corresponds to the location of the falls and dams on the river and they are practically concentrated at the following places: Cohoes, Little Falls, Herkimer, Amsterdam, Dolgeville, Hinckley and Rome.

The product is largely woolen and cotton goods, the Harmony mills at Cohoes being one of the largest in the country. They may be described in detail as follows, the specific reports of Mr. J. Birkhahn, inspector, being on file in the office.

At Cohoes, there are mills producing cotton bats and shoddies, with 2,562 employees; mills producing knit goods, with 3,775 employees; and mills doing dyeing and bleaching, employing thirty-five.

At Schenectady are very large iron, steel, and electric works, employing about 22,000 men, the wastes from which except for oil and grease, have little or no effect on the quality of the river. Besides these are manufactories of textiles and knit goods employing about 500 persons.

At Amsterdam are factories making knit goods employing about 4,000 persons; silk goods employing 440 persons; rugs and carpets, with 5,600 persons; dyeing and bleaching, with twenty persons.

The Chuctanunda creek which empties into the Mohawk at Amsterdam, on the banks of which a number of these industries are located, is badly polluted, the effects being clearly marked on the Mohawk.

At Fonda, the Cayadutta creek enters the Mohawk, bringing a large pollution from Johnstown and Gloversville. Fonda itself has one mill making astrachans and linings, employing 100 operators, and discharging dyestuffs and soap. At Johnstown, about fifteen miles up stream, are a large number of factories causing great pollution; 894 employees are engaged in manufacturing leather; 1,474 employees are engaged in manufacturing gloves; 278 employees are engaged in manufacturing knit goods.

A detailed account of this pollution and of the amount of organic wastes as well as their effect on the stream will be found in a special report by O. H. Landreth in the Ninteenth Annual Report, page 70.

At Gloversville, four miles further up stream, are located some of the largest leather and glove factories of the country. There are 1,400 employees engaged in the manufacture of leather and about 3,500 in the manufacture of gloves. Besides these there are eighty-one employees in silk factories, 176 in knit goods, making the amount of waste large and contaminating the stream to a lamentable degree. It is proposed to treat the sewage of the city and to discharge all the manufacturing wastes into the sewers, and studies are now being made with this in view. Johnstown on the other hand, after paying damages in several suits, has purchased the riparian rights on the stream for some distance below the city and claims immunity on account of further pollution.

At Canajoharie is a large creamery discharging nearly 1,000 pounds of whey daily.

At Fort Plain are two knitting mills with 425 operators, two small creameries and a silk mill with seventy operators, discharging used olive oil.

At Little Falls are large paper, wool, cotton and leather mills. The paper mills with twenty-five operators discharge their wood pulp waste. Two mills making knit goods, with 1,800 operators, discharge bleaching material and dyestuff. A leather company with 180 operatives discharges dogwood and washings, contributing materially to the pollution. A woolen mill with thirty operatives discharges dyestuffs and bleaching agents.

Dolgeville, the location of the American Felt Company, contributes dyestuffs, acids and alkalies to the waters of East Canada creek. The factory employs 175 operatives and the trade effluent is plainly distinguished by its color and by the effect of the soaps contained.

At Utica is a large mill making woolen and worsted cloths, employing 800 operatives, and discharging dyestuffs and bleaching agents. There is also a dyeing company employing thirty-five operatives, which discharges dyestuffs and a large amount of acid wastes and bleaching powder.

At Whitesboro is a large cotton mill, with 800 operatives, the wastes consisting of soda and lime, with a large quantity of muriatic and nitric acids.

At Oriskany is a felt mill employing about 200 operatives, which discharges dyes and bleaching material.

At Chadwick is a silk mill employing seventy-five employees, which discharges soap and oil. Also there is at the same place a leather company discharging spent logwood and refuse of process with visible effect on the quality of the river.

At Willowdale is the factory of a bleaching company with 350 operatives, discharging bleaching agents.

At Frankfort and at Mohawk are small factories making underwear, employing 325 operatives, the wastes of which are dyes and bleaching agents.

At Herkimer is a large mill making knit goods, with 300 operatives discharging lime and soda, and a woolen mill with 300 operatives both at Fultonville.

At Fultonville is a creamery, discharging salsoda and bleaching powder, and a silk glove factory with 150 operatives, discharging dyestuffs and soap waters.

It may be plainly seen from the above that there is discharged from factories into the Mohawk a vast amount of factory refuse or trades waste. The largest amount of waste comes from the cotton and silk mills, each discharging more or less bleachery agents and dyestuffs. The woolen mills, carpet mills and leather factories discharge large amounts of organic matter, such as grease. the subsequent putrefaction of which is highly objectionable. The conditions below Johnstown, below Little Falls, below Amsterdam, below Dolgeville and below Utica are particularly bad and suggestive of a public nuisance.

Certainly no serious effort can be made to reduce the pollution of the Mohawk river without taking into account the presence of this factory refuse, and no success can be anticipated in the way of restoring the river to its original purity without a thorough purification of all the factory waste before it is allowed to discharge into the river.

Drinking Water

Of all the cities on the watershed Cohoes and West Troy are the only ones which get their drinking water from the Mohawk in its lower reaches. Rome, from the dam at Ridge Mills, secures a water supply, but the pollution there is chiefly from the Black River canal, which brings down a large amount of organic matter.

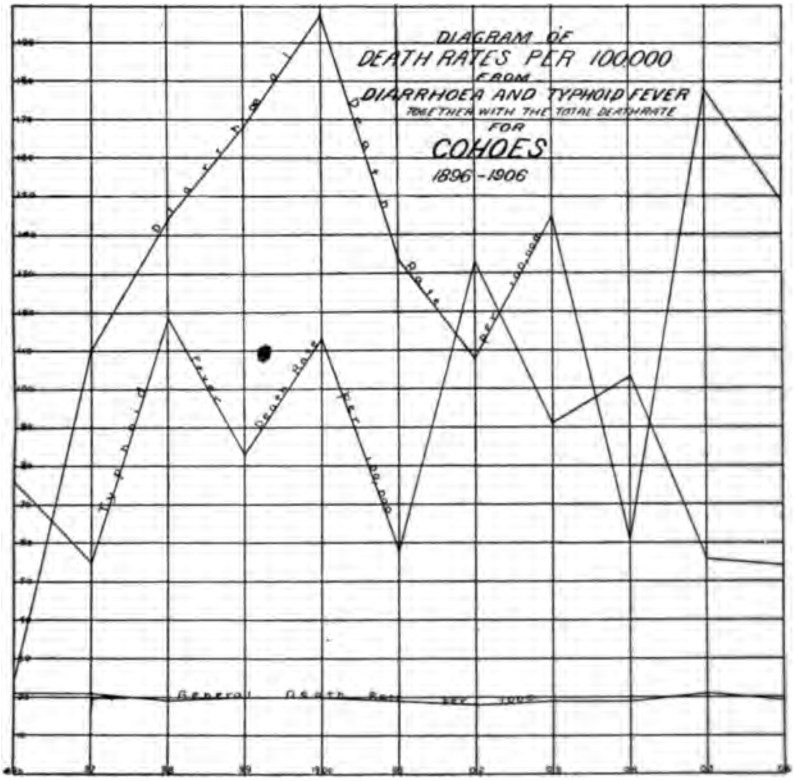
The pollution of the lower Mohawk has been carefully examined and reported on on two separate occasions, the first being a report of Prof. Wm. P. Mason on a series of typhoid epidemics in Schenectady, Cohoes and West Troy in 1890. The relation between the pollution of the Mohawk river and the number of cases of typhoid fever was very plainly marked, and although practically the same unfortunate condition exists at Cohoes and West Troy to-day, seventeen years later, no improvement in the quality of the water has been secured. The epidemic began in Cohoes in October, 1890, resulting in about 1,000 cases out of a population of 22,500, the epidemic being undoubtedly the result of an exceptionally large number of cases, seventeen miles up stream, in Schenectady in July, the sewage from the latter city being all turned directly into the river.

The Cohoes epidemic was followed through the entire winter by a similar epidemic in Albany, while the other cities of the vicinity, Waterford, Lansingburg and Troy, whose water supplies are from other sources, were not affected. West Troy, whose water comes from the Mohawk above Cohoes, also had an epidemic, but as soon as the conditions were realized arrangements were made for a supply of filtered water from Green Island, and further progress of the disease was stopped.

In the tenth, eleventh and twelfth volumes of the New York State Reports of the Department of Health, consecutive reports are made by Mr. C. C. Brown, then Consulting Engineer to the Board, on the sanitary conditions of the Hudson and Mohawk rivers, and a large number of chemical and bacteriological analyses are given, all showing a high degree of pollution by organic matter. The following diagrams show the effect of the use of the water on Cohoes and West Troy, as shown by the death rate of typhoid fever, from 10–20 per 100,000, being an average death rate for cities using water from large surface streams. By these diagrams it may be seen, that while the death rates from typhoid fever and from diarrhœal diseases are, on account of the constant infection, continually high — from three to six times a reasonable amount — there are times when, on account of peculiarly virulent infection, a more general and severe epidemic has resulted. Such was the case in 1890, referred to above. In Albany again in 1896 there was a serious wave of the disease, and doubtless there would have been later and more severe disturbances except for the installation of the admirable filter plant by which the safety of the water for drinking purposes is practically secured. In 1902, for example, judging by the extraordinarily high rate for Cohoes, the river must have been badly contaminated, and yet Albany was not conscious of it. Similarly in 1904. The average death rate from typhoid fever in Cohoes for the eleven years, 1896–1905 inclusive, is 88.6 per 100,000, or, for the population of Cohoes, about twenty-one lives are lost annually, of which about seventeen could be prevented by the installation of a filter plant. The value of these deaths may be conservatively estimated as follows:

17 lives lost annually at $3,000 each	$51,000
170 cases illness, medical attendance, loss of wages, etc., at $75	12,750
	$63,750

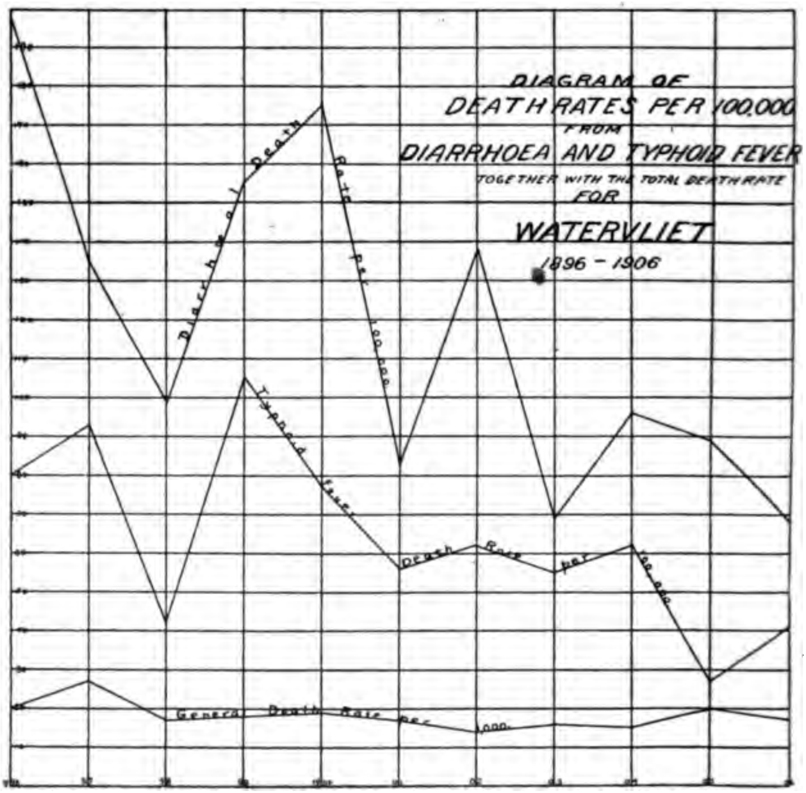
The domestic consumption of Cohoes is about 2,000,000 gallons per day; the cost of filtering this, including operating and interest charges, would be about $10 per million gallons, of $20 per day, or per year $7,300, a net saving of $56,450, which capitalized at 4 per cent. is $1,400,000. It is estimated that a suitable filter plant can be built for $100,000, showing that even with the low value assigned above to the human life, the city could easily afford to build protective works to prevent repetition of such excessive death rates. It is impossible, moreover, to estimate the waste of resources, and the inevitable sacrifices imposed upon a community subject to such demoralization. It is true that Cohoes is a manufacturing town with a large resident population of factory employees, many of them of foreign birth and not yet naturalized. It may be that Cohoes does not appreciate the value of the lives of her citizens lost in this reckless manner, but finds it easier to secure new residents rather than preserve the lives of those now resident. But such a policy must inevitably work ruin to the city where it is maintained. It must produce careless and irresponsible employees, and degrade the standards to which they have achieved. Such a policy must be entirely indifferent to the sorrows of widows and orphans and friends, to the breaking up of families, to the miseries and sufferings entailed.



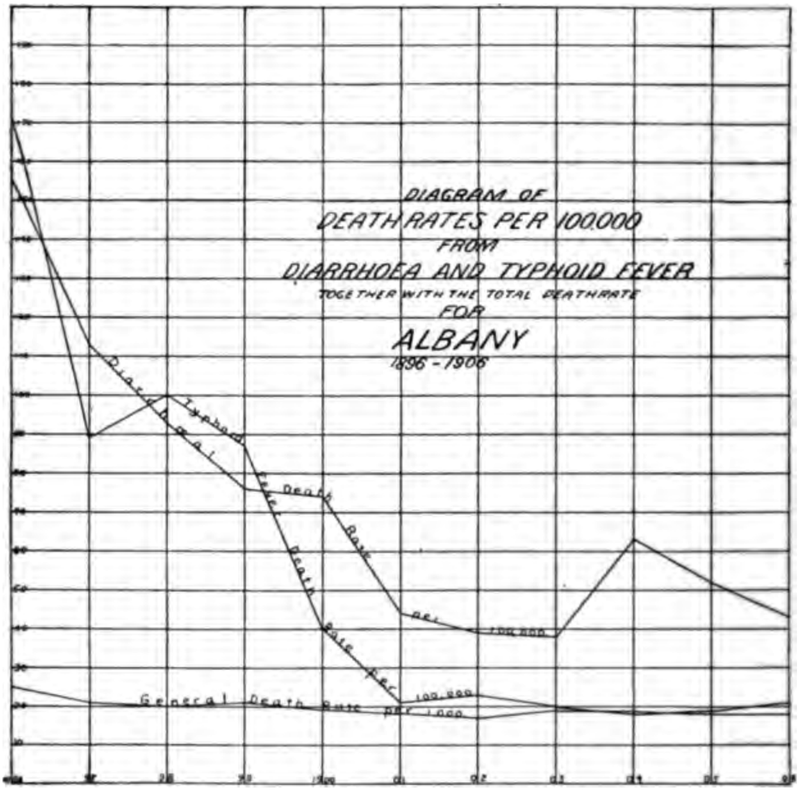
The Mohawk river water may be much improved, but can never be made pure drinking water, and Cohoes should for her own sake take immediate steps to install a filter plant, and the full authority of the Department should be used to compel her to do so.

Summary as to Distribution and Effects of Pollution.

The Mohawk valley is a highly developed agricultural and manufacturing district of New York State, the counties in the main valley showing a high density of population and a well-stocked farming district. The cities in the valley are large and numerous and, with the incorporated villages, contain 62 per cent. of the entire population of the watershed, the other 38 per cent. being



scattered over a large area of undeveloped country. The tendency in the district is for the population to increase in the cities, and there is as yet no indication of any counter tendency. The areas are largely deforested, and generally the soil is heavy, both indicating a rapid run-off. Direct observations of the flow confirm this, the spring floods being severe, though of short duration, and the low water flows being very small per square mile. The factories are largely producers of woolen and cotton goods, while tanneries, dyeing and bleaching establishments add to the intense pollution caused by their wastes. Local pollution in such quantity as to already threaten a public nuisance exists to-day on some of the tributaries on account of factory wastes, notably below Amsterdam and Dolgeville, and below Little Falls on the main river.



Moreover, the flow of the Mohawk itself, in its lower reaches, is insufficient to properly dilute the sewage at times of low water. Schoharie creek should be carefully protected on account of its extremely low summer flow. Cayadutta creek is to-day a public nuisance and a conspicuous example of the inefficiency of the present Public Health Law.

East and West Canada creeks, of all the watershed, have a sufficiently permanent flow and a small enough population so that no nuisance is to be apprehended from these waters. Oriskany creek, like Schoharie, has low summer flows and a present density of population that indicates such contamination that a nuisance may be looked for in the near future. West Canada creek is now the source of the water supply of Utica, and its quality is protected by water rules. Similarly, the upper part of the main river is protected by Rome water rules. Cohoes and West Troy use the Lower Mohawk for drinking water, and the effect of the pollution is shown by the high death rate from typhoid fever and diarrhea.

Conclusions and Recommendations

In view, therefore, of the serious condition of pollution of the Mohawk river which now exists as a result of the discharge therein of the sewage and waste from the vast population and numerous industries located upon its watershed; of the menace to the health and lives of the communities which reside along its course and must depend upon its water for sources of water supply; and of the detriment to comfort and convenience of those who live along its banks or use these waters in their daily life or industrial pursuits, I beg to recommend that every power of the State Department of Health vested in the Public Health Law be directed toward the reclamation of the purity of this large and important waterway of our State by

1. Prohibiting entirely the discharge of any additional unpurified sewage or industrial wastes into these waters.
2. Requiring the removal of all existing pollution from domestic sewage and tradesmen by the installation of such methods of sewage purification as will remove as far as practicable all matter of a dangerous or objectionable nature.

I further recommend:

3. That in order to satisfactorily accomplish this removal of pollution there be required a degree of purification of sewage and industrial wastes from all cities and villages situated along the river, and its main tributaries, as will produce a nonputrescible effluent.

4. That, as a safeguard against the menace and danger to all communities which now or may use the unfiltered Mohawk river for water supply purposes, every effort of the Department will be used to induce these communities to filter these supplies.

Respectfully submitted,

H. N. OGDEN,
Special Assistant Engineer

GENESEE RIVER WATERSHED

ALBANY, N. Y., *November* 15, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health, Albany, N. Y.:*

DEAR SIR:— I beg to transmit the accompanying report of Prof. H. N. Ogden, Special Assistant Engineer, on an investigation of the pollution of the Genesee river by the sewage and industrial wastes from the municipalities and industries located upon this watershed.

This report represents the third of the special investigations of this nature that have been carried out by the Engineering Division. This watershed taken together with the watersheds of the Upper Hudson, Oswego and Mohawk rivers, previously reported upon, comprises an area of about 15,500 square miles, or approximately one-third of the 48,000 square miles comprising total area of the State.

It may be appropriate to add here that although completed reports of investigations of only the watersheds above referred to have been submitted during the year, a considerable amount of field work on other watersheds has been performed and in some cases completed.

The accompanying report has been carefully reviewed by me and I beg to express my concurrence in the conclusions and recommendations stated therein.

Respectfully yours,
THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *November* 15, 1907.

MR. THEODORE HORTON, *Chief Engineer State Department of Health, Albany, N. Y.:*

DEAR SIR:—I beg to submit the following report of the investigation of pollution of the Genesee river and its tributaries by domestic sewage and trade wastes discharged therein by the municipalities and industrial establishments situated upon the watershed:

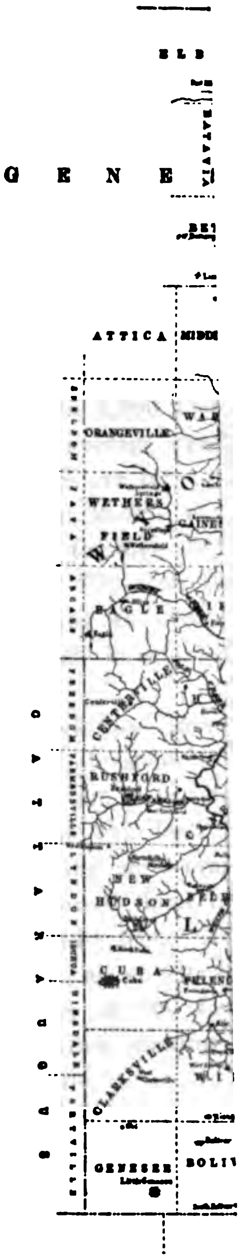
Hydrography

Among the rivers of New York State the Genesee is remarkable for its length, direction of flow and amount of its fall. Rising in the Allegheny Mountains it drains territory over 2,200 feet in elevation, but at its mouth at Lake Ontario it is only 246 feet above tide, giving an average gradient of about fourteen feet per mile. Regarding the head of the river proper taken at Genesee village, with elevation of 1,620 feet, and the elevation at Mount Morris as 560 feet, we find that 1,060 feet fall occurs above Mount Morris, and only 314 feet between Mount Morris and Lake Ontario. In right line distance this gives a gradient between Genesee and Mount Morris of nearly eighteen feet per mile, and between Mount Morris and Lake Ontario of less than eight feet per mile.

Tributary Slopes

Beginning with its tributaries nearest its mouth and passing southward the following grades are found:

Black creek, which joins Genesee river near Genesee Junction has an elevation of 522 feet, while at South Byron the eleva-


GENE
ATTICA
ORANGEVILLE
WETHERSFIELD
EAGLE
CENTERVILLE
RUSHFORD
NEW HUDSON
CUBA
CLARKSVILLE
GENESEE
BOLIV
CATTARAUGUS

tion is 680 feet, the approximate distance being twenty-five miles. The grade per mile is found to be about six feet.

Honeoye creek, the outlet of Honeoye and Hemlock lakes, has a length of about thirty miles, and a fall from Hemlock lake of 376 feet, and an average grade of over twelve feet per mile.

The Allen-Oatka creek at its mouth near Scottsville has an elevation of 520 feet, while at Warsaw its elevation is 980 feet, the distance being about thirty-six miles, making an average grade of thirteen feet per mile.

The Canaseraga creek empties into the Genesee near Mount Morris and has an elevation of 560 feet, while at its head waters it is close to 1,900 feet. Its length is about thirty-five miles, making an average grade of thirty-seven and seven-tenths feet per mile. Silver lake outlet empties into the Genesee two miles above Mount Morris, at an elevation of about 584 feet, while the elevation of the lake surface is 1,356 feet, making a difference of elevation of 772 feet, the distance being about six and one-half miles, causing an average grade of 118.5 feet per mile. This extreme grade is referred to later, when discussing the sewage of Perry.

Wolf creek flows into the Genesee about four miles below Portage, at an elevation of 690 feet, while at Silver Springs the stream has an elevation of 1,402 feet, making a difference of elevation of 712 feet, a distance traversed of only about six miles, making an average grade of 118.7 feet per mile.

Wiscoy creek flows into the Genesee at Rossburg at an elevation of 1,140 feet. At its head waters near Bliss, Wyoming county, it has an elevation of 1,740 feet, making a difference of elevation of 600 feet. The length of this stream is about fourteen miles, making an average of forty-two and eight-tenths feet per mile.

Cold creek flows into the Genesee river at Fillmore, at an elevation of 1,173 feet, while at Centreville near its head waters, a distance of about ten miles, its elevation is 1,700 feet, making a difference of elevation of 537 feet, or an average grade of fifty-three and seventh-tenths feet per mile.

Caneadea creek forms a junction from the west side at Caneadea, with an elevation of about 1,237 feet, while at Rushford, not far from its head waters, a distance of eight and one-half miles, we find an elevation of 1,750 feet, making a difference of elevation of 513 feet, or an average grade of sixty and four-tenths feet per mile.

Black creek joins the Genesee one-half mile above Belfast from the west, with an elevation of about 1,295 feet. At its head waters, near Black creek, is found an elevation of 1,491 feet, or a difference of 196 feet, making an average grade of twenty-one and six-tenths feet per mile.

Wigwam creek flows into the Genesee from the east almost opposite the Black creek mouth. This is a comparatively small stream with very steep grades.

White creek flows from the west about one mile above the mouth of the Black creek, at an elevation of about 1,297 feet. The head waters of the White creek are close to the Allegheny watershed divide, with an elevation of about 1,800 feet, making a difference of elevation of 603 feet, the length of the stream being about eleven miles, causing a grade of about fifty-four and eight-tenths feet per mile.

The Angelica creek flows into the Genesee from the east about one mile north of Belvidere, at an elevation of about 1,310 feet. Its head waters are at an elevation of about 1,800 feet, and the length of the stream is about ten miles, making a difference of 490 feet and a grade of about fifty-nine feet per mile.

Dyke's creek joins the Genesee from the east at Wellsville, at an elevation of about 1,497 feet. This stream rises close to the east line of Allegany county, at an elevation of about 1,775 feet, the length of the stream being about fourteen miles and difference of elevation of 378 feet. Here is an average grade of about twenty-seven feet per mile.

Between Wellsville and Scio are found two streams entering one from either side, Knight creek from the west and Vandermark creek from the east. Both of these streams are comparatively small and rise sharply into the foothills of the Alleghenies.

General Surface Slopes

The general surface slopes are outlined quite closely by studying the grade of the main stream and its tributaries as given above. That portion of the river valley and its tributaries lying between Lake Ontario and a line drawn east and west through Mount

Morris has a comparatively low grade, and the surface of the water shed is comparatively flat, the streams flowing in a sluggish manner. But south of this point commences the hilly country, which develops into the Allegheny Mountains along the southern rim of the State.

The broad valley bottom of the river at Mount Morris is about two miles wide and decreases northward, but south of Mount Morris it flows through a rocky gorge almost the entire distance to Portageville. Above Portageville there is again a valley of from one-half to one mile wide, extending to a point above Wellsville.

The Black creek stream, which enters at Genesee Junction, has a comparatively high slope, with many riffles, but the Oatka-Allen creek, which drains also from the west side, from a point below Warsaw to its mouth, is a sluggish stream, receiving the sewage from Wyoming, Pearl Creek, Pavilion, Le Roy, Caledonia and Mumford, and with the exception of a sharp fall through the village of Le Roy, there are very few riffles. This stream is evidently very badly polluted, and has but little chance to recover itself, due to its sluggish nature.

The Canaseraga creek has a comparatively high grade and receives the sewage effluent from the village of Dansville, together with the unsewered wastes from Groveland, Canaseraga and Swains. Fortunately the village of Dansville has an excellent disposal plant, which has been in operation only about six months, and its percentage of purification is high. The tributaries south of Mount Morris all have high grades, and each will be taken up under the heading of "Sewage Pollution."

Geology and Soil Conditions

The entire Genesee watershed has been materially altered by the effects of the ice sheet during the glacial period, which in its retreat left vast deposits of drift. The amount of glacial drift still remaining in the valleys is very great. This is surprising when we consider the erosive power of the present streams, due to their grades, for a vast amount of drift has certainly been removed. In some localities the river valley is sufficiently open, either by absence of drift or by subsequent clearing, to show its original form, but in many places huge drift hills obstruct the view. In at least two instances the old river valley was so completely closed by the drift that the river has been diverted into a new channel, and in the cases of the side valleys and tributary streams this diversion of drainage has been frequent. In most sections the valley drift has been partly terraced, or leveled by the successive work of glacial lakes and streams. Upon these plains are found most excellent farms, the farming territory between Mount Morris and Rochester being especially fine, and devoted to the raising of sweet corn and other vegetables, and a large amount of fruit. The composition of the drift deposits has not been closely determined, but casual observation suggests that while a large amount is true moraine, that probably the greater mass is water laid drift and sand. At Portageville an impregnable barrier of drift was left by the glacier that blocked the old valley, which may have been two miles wide. A lake was thus formed, and the water found its outlet over the western rock wall of the preglacial valley, and the down cutting through the portage shales has resulted in the famous ravine and falls.

The river found its old valley at Mount Morris, in which it flows from Mount Morris to a point near Avon, where it was again blocked by a barrier of drift, and again it found an outlet upon the western side, flowing to Rochester, through a new channel, and cutting a gorge to the lake, very similar to that found at Portage. The deserted portion of the old valley between Portage and Mount Morris is partially occupied by the Keshequa and Canandaigua creek.

The drainage history of the Genesee valley is one of the most remarkable and dramatic stories in geological literature, and it does not seem probable that any other hydrographic area can equal it.

"During the long time, to be counted in many thousands of years, while the south edge of the ice sheet was slowly receding or backing away from south to north across New York State, the waters over the Genesee basin were held up to high levels, being forced to overflow east or west. In the successive lowering of the waters by the opening of northward outlets at least seven great river systems have received (and some of them more than once) the contribution of Genesee waters. In order of time these are as follows: 1. Pine Creek-Susquehanna: 2. Allegany-Ohio-Mississippi: 3. Canisteo-Chemung-Susquehanna: 4. Glacial lakes Warren and Chicago to Mississippi: 5. Mohawk-Hudson: 6. Gilbert Gulf (Sea level waters in the Ontario basin): 7. St. Lawrence."*

The surface soils of the Genesee drainage area are mostly clayey and relatively impervious — especially over the uplands. This fact counts partially for the rapid run-off of the southern or head waters. In the valleys the drift accumulations are partially gravel, and local areas on the uplands are gravelly, which help in some degree to hold back the excessive water. The deep lacustrine fillings — like that in the Dansville-Mt. Morris-Avon stretch, probably require a large volume of water for saturation.

The Genesee river has its sources in Potter county, Pa., in the subcarboniferous rocks, and in its northward flow it traverses in descending order all the strata of the Devonian system, and those of the Silurian, as far down as the Medina. For more than half its length, or to near Mt. Morris, the river traverses Chemung and Portage sandstones and shales. It then traverses the Hamilton shales, the Onondaga limestone and the Salina shales, which contain salt beds. Above Rochester the river reaches the Lockport limestone, the Rochester shale, the four strata of the Clinton, and (two shales and two limestones, including the band of Clinton iron ore) 100 feet into the Medina shales.

The sheet of drift which covers the river basin has been derived from the outcrop of all these rocks, and to some extent from the rocks of the northeast as far as the Crystalline area of Canada, and the Adirondacks. It follows that neither the trunk stream nor any tributary is wholly affected in its chemical content by the underlying hard rock, but largely by the drift or the grist of the glacial mill.

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* The geological history of this section is found in the extensive writings of Prof. H. L. Fairchild, University of Rochester, as follows:

Glacial Lakes of Western New York. Geol. Soc. Am., Bull., VI 353-374, April, 1895.

Glacial Genesee Lakes, ibid., VII 423-452. April, 1896.

Glacial Waters in the Finger Lakes Region of New York, ibid., X 27-68, February, 1899.

Pleistocene History of the Genesee Valley, in the Portage District.

Timber and Cleared Land

With the exception of a portion of Allegany and Steuben counties, the percentage of wooded country is very small. The high ridges between Cuba and Friendship and on either side of the Dyke creek valley, and the slope of the Canaseraga creek above Dansville, and the slopes of some of the minor streams in Allegany county, are covered by a second growth of timber. There is no virgin timber upon the whole watershed, with the exception of a few preserves on the well-known Wadsworth estate between Geneseo and Avon. The following table shows the percentage of area in the several counties of the watershed, which according to the United States census for 1900 are reported as farms improved:

County.	Total acreage.	Improved farms.	Percentage.
Allegany	593,888	408,252	68.7
Genesee	294,316	242,307	82.5
Livingston	373,660	300,860	81.2
Steuben	825,334	610,181	74.0
Wyoming	367,894	270,374	73.7
Monroe	381,941	339,870	89.1

(The percentages of cleared land is still higher than this table shows, because much of the broken land is deforested, and yet used for pasturage.)

The northern portion of Livingston county and Allegany county and a portion of Wyoming county is an ideal dairy country, springs being very frequent, while comparatively few springs occur through the flat country toward Lake Ontario.

Population (Density)

The density of the population on this watershed, not counting the city of Rochester, is slightly above that of the whole State as given by the State Water Supply Commission, which it states as fifty per square mile, exclusive of cities and large villages.

The population is made up as follows:

County.	Population
Livingston	36,450
Allegany	37,457
Steuben	3,000
Wyoming	23,055
Ontario	2,500
Genesee	12,000
Monroe (Rochester excluded)	25,000
Total	139,462
Rochester	181,656
Total	321,118

The average population per square mile, Rochester excluded, is fifty-five, and if Rochester is included, the average population is 128 per square mile. The area drained is about 2,500 square miles.

The only city on the watershed is Rochester, and the number of sewered villages is comparatively small. The following table shows the population of villages having partial or complete sewer systems discharging into the Genesee river or its tributaries:

Name of place.	Population
Wellsville	4,355
Belmont	1,207
Warsaw	3,196
Perry	3,749
Le Roy	3.395
Honeoye Falls	1,208
Avon	1,782
Geneseo	2,245
Sonyea	1,350
Dansville	3,908
Total	26,395

Table showing the population of incorporated villages upon Genesee river watershed draining into the main stream or its tributaries:

Name of place.	Population.
Andover	1,097
Wellsville	4,355
Belmont	1,207
Friendship	1,259
Belfast	886
Pike	457
Bliss	301
Castile	1,000
Silver Springs	817
Warsaw	3,196
Perry	3,749
Le Roy	3,395
Bergen	601
Churchville	645
Scottsville	858
Caledonia	1,221
Honeoye Falls	1,208
Lima	1,001
Avon	1,782
Livonia	782
Geneseo	2,245
Mount Morris	2,611
Sonyea	1,350
Dansville	3,907
Nunda	1,0[illegible]
Total	41,924

The density of population of the rural area is found by subtracting the population of the villages from the total population exclusive of Rochester, and found to be 97,538, giving a population of forty per square mile in the rural districts. Therefore, about 69½ per cent. of the total population live in the cities and incorporated villages, while the remaining 30½ per cent. live in the rural districts and hamlets.

Volume of Stream

There is probably no other stream in the State which is subject to as much variation in flow as the Genesee river. This is due very largely to the fact of the high grades upon its higher reaches, with practically no still water, such as lakes or dams, to impound the water, and freshets occur of disastrous character, about every five or eight years, while annual freshets of lesser amount occur every spring. During the period of storms the waters have no natural hindrance and reach the main stream very quickly, bringing down large amounts of wash, and the upper reaches of the river have been changed from a clear stream, of say forty cubic feet per second, to a violent turbid stream, carrying 300 cubic feet per second upward in a period of ten hours. When these freshets reach Mount Morris the natural gentle slope of the river valley tends to hold back the sudden onslaught of the flood, and the flow of the stream from this point to Rochester is much more uniform. From gaugings made at the Court street dam, in the city of Rochester, by city engineer and also geological survey, it was found that the average low water flow was about 400 cubic feet per second; but in times of extreme drought it may have fallen to 200 cubic feet per second. It might be fair to assume that the average flow of the stream throughout is 300 cubic feet per second, which is increased to its maximum by the addition of its tributaries.

The following is the probable minimum flow from the different tributaries beginning near its headwaters:

Tributary	Cu. Ft. per Sec.
Cryder creek	5
Dykes creek	8
Knight creek	3
Vandermark	3
Phillips creek	8
Van Campen creek	10
Angelica creek	16
White creek	10

Tributary.	Cu. Ft. per sec.
Black creek	8
Wigwam creek	3
Crawford creek	5
Caneadea creek	10
Rush creek	6
Cold creek	10
Wiscoy creek	30
Wolf creek	12
Silver lake outlet	15
Canaseraga	30
Conesus lake outlet	15
Hemlock outlet	15
Allen-Oatka creek	30
Black creek	25

Volume of Sewage Pollution

Considering now the several parts of the watershed by themselves, taking them in order upstream, we find the following relations between the stream flow and the sewage flow:

Black creek has a watershed whose population is about 6,000, and the volume of the stream being about twenty-five cubic feet per second, there is a dilution sufficient to avoid all nuisance, and in fact the stream is found to be high in dissolved oxygen and there is no probability of future nuisance ever occurring upon this watershed.

Allen creek has a watershed containing about 20,000 persons, and a consequent sewage flow of about 3.6 cubic feet per second, which would cause a dilution of about 8.4. The sewage flow into the stream is spread over a long stretch of territory, and a dilution higher than this actually exists; but at the same time local nuisance has occurred at Le Roy and is constantly occurring at Warsaw. The sluggishness of the stream does not tend to purify itself, and of all the tributaries of the Genesee, the Oatka-Allen creek is at the present time in the worst condition. A disposal plant at Warsaw would be a simple matter, because their present sewers were planned with that ultimate object in view. From present indications the citizens of Warsaw have no intention of bettering their condition. The question of a new sewer system and disposal plant at Le Roy is at the present time being agitated, and in the course of two years will probably see a change for the better in this place. The small villages of Wyoming, Rock Glen, Pearl Creek, Pavilion, Caledonia and Mumford do not have sewers, and their waste will not materially change the condition of the stream, as far as nuisance is concerned.

Conesus lake outlet drains an area containing about 2,000 persons and during the summer season a poulation of probably three times this amount. The lake, containing about 4.8 square miles, is sufficiently large so that ample sedimentation occurs to avoid all nuisance. But, unfortunately, this lake is used for a drinking water supply by the villages of Geneseo, Avon and Livonia, and the increasing number of summer cottages along its shores has increased the pollution to such an extent that the village authorities of Geneseo have recently given notice that citizens should cease using it as drinking water without its being boiled. The villages of Avon and Livonia are each expecting trouble from their drinking water source and beyond a doubt some drastic sanitary regulation must be enacted if Conesus lake is to be used as a drinking water supply.

Honeoye creek drains Hemlock lake, which is so well protected by the authorities at Rochester that it is not necessary to discuss this lake. Honeoye Falls and Lima are two unsewered villages with a total population of 2,000 located below Hemlock lake outlet.

Canaseraga creek is one of the four most important tributaries, the other three being Oatka-Allen creek, Black creek, and Wiscoy creek. Canaseraga creek contains upon its watershed the villages of Sonyea, Tuscarora, Nunda, Oakland, Hunt, Dalton, Dansville, Groveland, Canaseraga and Swains, with a total population of about 18,000, and with an estimated sewage flow of three and eight-tenths cubic feet per second, but fortunately Dansville, having a new disposal plant consisting of the latest type of septic tank and contact filters, the pollution of Canaseraga creek is comparatively low. Its high grade causes it to have many riffles and small falls, which give it plenty of opportunity to purify itself.

Perry lake outlet drains a population of about 8,000, half of which is sewered. The village of Perry, and the several small villages around Silver lake, cause a large amount of sewage, which is discharged raw into Silver lake outlet below the village. The plan of the sewers of Perry is such that all the sewage is carried to one main, and a disposal plant can easily be installed whenever it is considered necessary. The remarkable fall from Perry to the Genesee river in the stream bed aids materially in the correction of the pollution which occurs, and it is doubtful if the stream is polluted to any perceptible amount where it joins the Genesee.

Wolf creek has the villages of Castile and Silver Springs upon its watershed, with a population of about 2,500. At Silver Springs a large portion of the stream is diverted for use in the salt plant, and when it rejoins the main stream it is highly charged with brine, which is nearly boiling hot. This water is allowed to settle for a short time in a pond, but even then the effluent is so high in chlorine that it is unfit as a source of drinking water for livestock. The salt company has paid damages to all the bordering landholders below its plant until it reaches the mouth, but it is unfit for any purpose whatever at the present time.

Wiscoy creek watershed has a population of about 5,000 for the villages of Wiscoy, Pike, Bliss and Gainesville. The sources of this creek are remarkably large springs, and there is probably no stream west of the Adirondack mountains which is so constant in its flow, and of equal purity. It is filled with brown, speckled and rainbow trout, and the temperature probably never rises above fifty degrees Fahr. None of the villages named are large enough to be sewered for many years to come, and there is no doubt but what the Wiscoy creek materially improves the condition of the mother stream below its mouth. Cold creek is another spring water stream, but much smaller, and in the dry season becomes scarcely more than a rivulet for the last two or three miles of its lower reaches.

Rush creek does not have any village upon its watershed and needs no discussion.

Caneadea creek has Rushford upon its watershed and a consequent population of about 2,000, none of which is sewered. The condition of this stream for many years to come will not need investigation.

Crawford creek, Wigwam creek and White creek have no villages upon their watersheds.

Black creek (Allegany county) has the villages of Rockville and Black Creek, and has a population of about 1,000, none of which is sewered. The ample fall of this stream causes it to recover whatever pollution may occur.

Angelica creek watershed contains Angelica, and its surrounding population of about 2,500, none of which is sewered, with a consequent dilution far above that necessary to avoid nuisance.

Vandermark creek, Knight creek and Phillips creek are all streams with no villages upon their watersheds.

Van Campen creek has the villages of Wirt, Nile and Friendship, with a resulting population of about 3,000, none of which is sewered. The flow of the stream is sufficient to cause plenty of dilution to whatever sewage may find its way to the stream.

Dyke's creek has Andover and several small hamlets with a total population of about 2,500, none of which is sewered.

Cryder creek is a small stream which has Whitesville and a total population of about 1,000 without sewers.

Special Sources of Pollution

The village of Wellsville is particularly unfortunate in having a refining company located about 4,000 feet above and directly upon the bank of the Genesee river, which is constantly pouring both acid and alkaline wastes into the stream to the amount of three to five cubic feet per second, which is probably 20 per cent. of the size of the stream itself. These wastes are of such a nature that they have practically killed all the fish from that point down to Belmont, and in all probability this company has exceeded the limits which are stated in its permit to dump refuse into the stream. At the time of the inspection, the Fish and Game Department were making a special investigation of these wastes. These wastes are of especial interest to Wellsville because its drinking water supply is taken from what is practically a small island in the river about 4,000 feet below the refinery, and there have been found occasions when it was necessary to take water supply from the river into the water mains at the time of fire, and danger of disease consequently results from the polluted water which remains in the pipes. Wellsville does not own its own water system, and cannot, therefore, change its drinking water supply at will, but some steps should be taken toward improving its source of supply. Plenty of spring water can be found upon the hills south of Wellsville.

One of the most frequent sources of pollution which exists upon the whole watershed are the wastes which come from the creameries and the cheese factories. There seem to be no regulations regarding the wastes from this industry, and the whole territory is thickly dotted with creameries, condensers and cheese factories, ranging from one to three miles apart, and the waste from each factory may be estimated at one cubic foot per second. Fortunately the wastes from these factories are not of a serious nature, being chiefly washings from the tanks, and the discarded whey after the curd has been removed. The aggregate of these wastes will probably amount to 10 per cent. of the trunk stream, if they could all be gathered at one place.

At Dansville there is situated a paper mill, whose wastes are considerable, and which do not drain into the city sewer. These wastes should be treated, or else arrangements made by which they can be turned into the ciity sewers and thus be treated at the city sewage disposal plant.

Salt Beds

Lying in a band north of a parallel through Warsaw, and reaching as far north as Le Roy, the whole country is underlaid by a salt bed, which occurs in the Salina shales at an average depth of about 1,100 to 1,200 feet. Formerly there were salt plants in operation at Rock Glen, Silver Spring, Warsaw, Le Roy, Perry, Cuylerville, Piffard, Retsoff, and Retsoff Junction, but at the present time only those at Silver Springs, Rock Glen, Piffard, Retsoff and Cuylerville are in operation. The waste from these is considerable and the chlorine content of the river probably much higher than that normal to this section of the country.

Conclusions and Recommendations

The general health of the entire watershed is very good, and typhoid was found in but few places, Wellsville being the principal sufferer. The drinking water supply upon the entire watershed is taken from wells and springs with the exception of Perry, which uses Silver lake water, and Geneseo, Avon and Livonia, which use Conesus lake water, and the city of Rochester, which uses Hemlock lake water. The village of Dansville takes its main supply from a small spring stream, known as Mill creek, and the village of Nunda takes its drinking water supply from a small spring creek known as Towns creek.

There seems to be no probability in the future of using the Genesee as a drinking water supply, but if the sewage of Wellsville, Avon, Geneseo, Warsaw, Le Roy, Mt. Morris were taken care of by disposal plants, it would leave the Genesee in a remarkably pure condition through a large portion of the year. At present, due to the rapid flow of surface water at time of flood, the pollution must be very high.

I beg, therefore, to recommend that the resources of the Department be expended in an endeavor:

1. To secure the construction of sewage disposal plants in Wellsville, Avon, Geneseo, Warsaw, Le Roy and Mt. Morris.
2. To prevent the pollution of Conesus lake, which could be done by enforcing the water rules enacted to protect the water supply for the villages of Geneseo, Avon and Livonia.
3. To improve the water supply of Wellsville.
4. To prevent further pollution of the main river and of its tributaries.

Respectfully submitted,

H. N. OGDEN,
Special Assistant Engineer

INSPECTION OF THE SANITARY CONDITIONS OF CITIES

ALBANY, N. Y., *December* 15, 1907.

EUGENE H. PORTER, M.D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— I beg to transmit herewith three special reports covering investigations by the Engineering Division of the sanitary conditions in the cities of Ogdensburg, Niargara Falls and Poughkeepsie.

These investigations and reports represent the first of a series which you have directed me to have carried on in certain cities of the State, chosen with respect to their relative typhoid fever or total death rate as compared with the general typhoid fever and total death rate of the State. In general those cities were selected whose death rates were excessive, or at least considerably above the normal for the State. It was expected that the investigations in such cities would reveal at once the cause for the high death rates, and that following a correction or improvement in these conditions the death rates would be reduced in these cities, and, in view of the proportionately large population in these cities, a corresponding reduction of the death rate in the entire State.

The field work and collection of statistics incident to these investigations were carried on by special engineering inspectors appointed for this particular purpose, who reported to Prof. H. N. Ogden, Special Assistant Engineer, under whose immediate direction these investigations were carried out. The inspector in each case visited the city, made careful personal inspection of the sanitary conditions of the systems of water supply and sewerage; of the streets and methods of cleaning and maintenance; of the sources and purity of the milk supply; of the methods and efficiency of garbage disposal; and other features that might in any way affect public health or be a possible factor in the cause of the high mortality from infectious diseases.

The accompanying reports prepared by Prof. H. N. Ogden, Special Assistant Engineer, contain a full description of the sanitary conditions found to exist in these three cities. The reports contain in each case conclusions as to the particular insanitary conditions that may be the cause of the excessive death rate, and recommendations as to the action that should be taken by the municipal authorities to improve these conditions and thus reduce this death rate. The reports have all been carefully reviewed by me and meet with my full approval.

Respectfully yours,

THEODORE HORTON,
Chief Engineer

OGDENSBURG

ALBANY, N. Y., *November* 5, 1907.

MR. THEODORE HORTON, *Chief Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR:— I have the honor to submit herewith a report on the sanitary condition of the city of Ogdensburg, being the first of the series of investigations on the sanitary conditions of cities made by your direction during the past summer:

Historical

On September 30, 1748, a French Sulpician monk, Francis Piquet, started from Quebec, with twenty-five Frenchmen and four Iroquois Indians, to establish a mission among the Indians who lived in the wilderness south of the St. Lawrence river. At that time France claimed dominion over the greater part of the central States, together with the St. Lawrence valley, and though her actual possession was confined to the shores of the rivers, yet she claimed the entire drainage area of those rivers. England held the Atlantic coast from Maine southerly, and Spain was in possession of Florida and the adjoining shores.

For nearly 100 years France and England had wrangled and fought over their boundary lines, and it is quite possible that the monk, possessed of a very martial spirit, may have had the location of a frontier fort in mind quite as much as a mission among the Indians. On May 30, 1749, Piquet reached the mouth of the "Riviere de la Presentation," also called Soergatzy, the name since changed to Oswegatchie. He at once built a storehouse, a small fort and dwelling-houses. Inducements were held out to the Indians to settle there by distributing clothing, provisions and arms, and an Indian village was soon established, the men being trained by the good monk to defend themselves by arms, if necessary.

On the breaking out of open hostilities between the French and English in 1754, the Indian colony contained about 3,000 persons, and Piquet and the fighting men of his colony attacked and conquered one after another of the English forts on the shores of the Great Lakes. They distinguished themselves in expeditions against Saratoga, against Crown Point and Ticonderoga on Lake Champlain, against Oswego and against forts on the Mohawk river. But in 1760, after the battle on the Plains of Abraham, the French gave up the struggle and the monk deserted his colony and the few remaining Indians.

About 1790, thirty years later, Samuel Ogden of New Jersey, who had married a sister of Gouverneur Morris, the resulting acquaintance leading him to purchase lands in New York State, wrote to Governor Clinton of New York State, complaining that although he and his associates had in 1785 paid the State a large sum of money for lands in the northern part of New York, English subjects from Canada were cutting timber on those lands, and thereby robbing him and his associates of valuable property.

In 1795, Nathan Ford, who seems to have been the real founder of Ogdensburg, was despatched by Samuel Ogden to begin the settlement of the village, with particular instructions to build a dam and start a sawmill and gristmill. For ten years Judge Ford had abundant opportunity to display the energy and perseverance which early history shows were his strongest characteristics. He succeeded, in 1798, in building his gristmill, and in the first eleven months ground over 6,000 bushels of grain. He was greatly impressed with the fact that immigrants, going west from New England, took the easy Mohawk valley route, and avoided the vicinity of Ogdensburg, and he was very anxious to have a road cut through from Ogdensburg to Albany. In 1805 a road was opened from Ogdensburg to Carthage, and so to the Mohawk river, and during that year agents were sent through New England to extol the advantages of Ogdensburg. From then until the War of 1812 the village continued to thrive, but after the war broke out its position directly on the border created great confusion in the village and absolutely interfered with further growth. In November, 1812, a British force crossed the river on the ice and successfully braved the determined resistance of the citizens and a small company of regulars. They captured the village, destroyed private property and made prisoners of the garrison of the fort. For the next two years the movements of the armies of both sides, both on land and water, resulted in a state of continual confusion and prevented any stability of residence, and it was not until several years had passed that normal conditions were restored.

Much energy was expended in the early days to promote navigation on the St. Lawrence river, but it was left to the Canadian government to make of the river the magnificent highway which it now is. Nor were efforts to improve the navigation on the Oswegatchie more successful, and it was not until 1850, when the Northern railroad from Ogdensburg to Rouses' Point was opened, that Ogdensburg had satisfactory intercourse with other cities besides places on Lake Ontario.

The following table shows the growth of population since 1810:

YEAR.	City.	Town outside city.	Total.
1810		1,245	
1820		1,661	
1825		3,133	
1830		3,924	
1835		4,656	
1840		5,719	
1845		6,414	
1850		7,756	
1860	7,409		
1865			11,091
1870	10,076		
1875	10,358	2,806	13,164
1880	10,341	2,881	13,222
1890	11,662	2,346	14,008
1900	12,633	2,368	15,001
1905	13,179	2,303	15,482

and diagram 1 shows two curves, one for the growth of the town since 1810, the other for the growth of the city since 1875.

To-day Ogdensburg is a city of homes, with no tendency to become a great industrial community, nor yet a commercial nor financial center. As Charles Mulford Robinson has recently said:

> " Ogdensburg is a city with business enough to keep it thriving and prosperous without the wrecking of men — on the one hand of the very rich through overstrain, and on the other hand by the creation of a large class of the very poor in pocket and in mind and spirit. The immigrants brought into Ogdensburg tend now, and may increasingly tend, to be of that desirable class who come because of the attraction of a beautiful city, which is cool in summer, with lovely shaded streets, pleasant walks and drives, charming views, and itself a center whence many delightful trips may be taken, while always there is the attraction of the superb river on one whole side, and of the pretty Oswegatchie flowing through the town."

This characterizes the place, and the conditions, outwardly at least, are essentially those which should give a low mortality and offer every inducement to rugged and prolonged vitality. This, unfortunately, is not the existing condition. In 1832 the dread Asiatic cholera appeared in America, the first case appearing in Quebec on June 8th. Cases were reported on the 14th at Montreal, and on the 17th, at Ogdensburg.

In 1854 a second cholera epidemic was introduced into Ogdensburg by immigrants from Europe passing up the St. Lawrence river. The cases, however, were chiefly confined to the laborers on the Northern railroad, then under construction. The mortality was very heavy, or one-half the number of those attacked.

In 1874 a serious smallpox epidemic broke out, probably imported from Canada, and in 1885 a general vaccination was ordered on account of the large amount of smallpox at Montreal.

Death Rates

But occasional outbreaks of contagious diseases are not as serious an evidence of indifference to sanitation as a continuous high death rate, both from all diseases and from the specific diseases

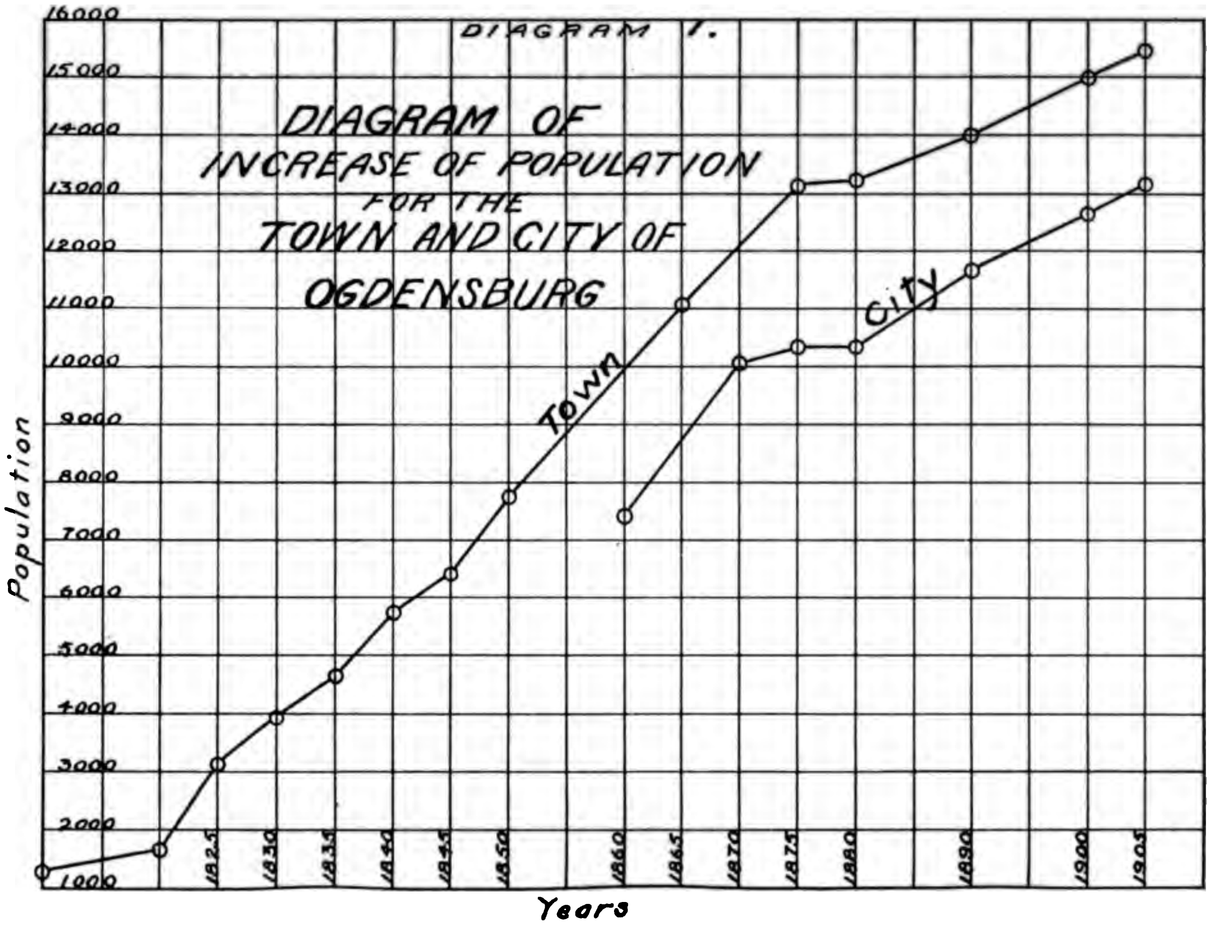


DIAGRAM 1.
DIAGRAM OF
INCREASE OF POPULATION
FOR THE
TOWN AND CITY OF
OGDENSBURG
Town
City
Population
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
Years
1825
1830
1835
1840
1845
1850
1860
1865
1870
1875
1880
1890
1900
1905

DIAGRAM 2.

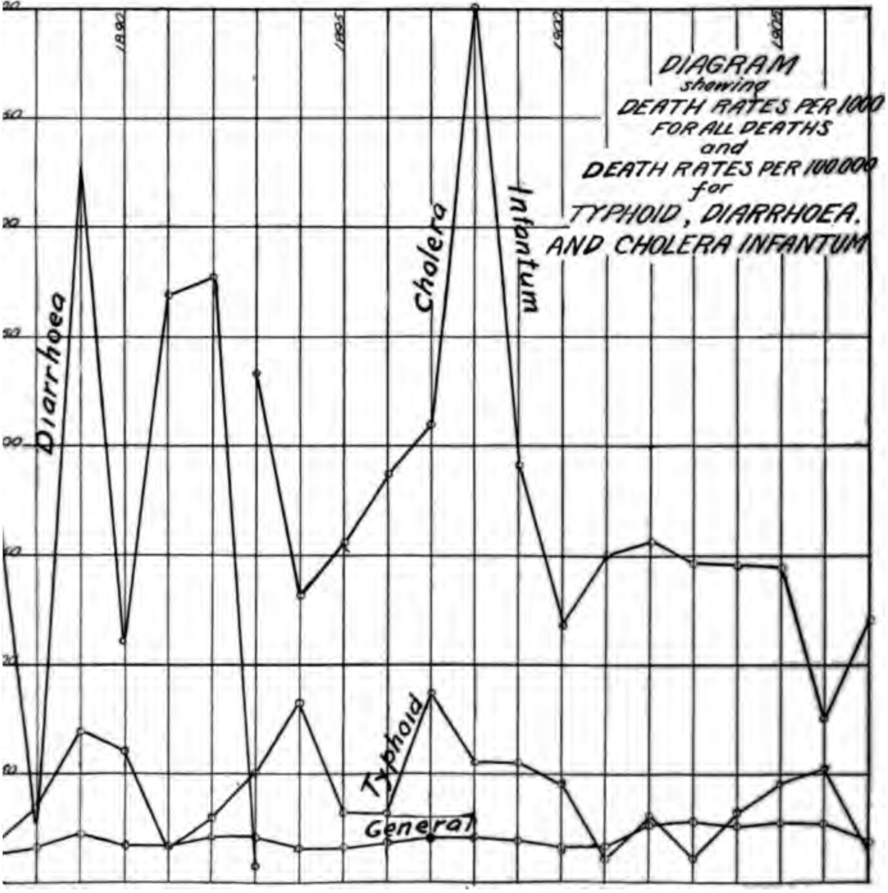


DIAGRAM
showing
DEATH RATES PER 1000
FOR ALL DEATHS
and
DEATH RATES PER 100.000
for
TYPHOID, DIARRHOEA.
AND CHOLERA INFANTUM
1890
1895
1900
1905
Diarrhoea
Cholera
Infantum
Typhoid
General
20
50
20
50
00
50
20
10

known as zymotic. The general death rate per 1,000 persons is shown by the heavy line at the bottom of diagram 2. It shows from figures taken from the reports of the State Board of Health that the total deaths in Ogdensburg vary between 150 in 1887, to 366 in 1903, or the death rate varies from 13 to 29 per 1,000. The average death rate for the State for the past five years has been 17.6 while the death rate for Ogdensburg for the same time has been 28.1, more than ten deaths in excess, or about 130 deaths in Ogdensburg which stand as a first argument against the present sanitary conditions of that city.

Turning our attention to the typhoid fever curve we find it varies from eighty-two in 1894 and eighty-seven in 1897, to eleven in 1901 and 1903, whereas a reasonable death rate from typhoid fever lies between ten and twenty, all per 100,000. The fact that the typhoid fever death rate in Ogdensburg for the years 1887–1906 is 41.2, or more than double a moderate and reasonable rate, is a second argument against the present sanitary condition of Ogdensburg.

Again, the health of a community is indicated by the number of deaths of children under five years old, children under that age being particularly susceptible to unsanitary conditions. The ratio of deaths under five to total deaths in average communities is about 30 per cent. In the year 1893 the number of deaths under five was 193 as compared with a total of 253 deaths, or 76 per cent., although for the twenty-year period 1887 to 1906, the deaths under five averaged seventy-eight, compared with a total mortality of 255, or 30 per cent. The diagram shows great variation and suggests conditions not under sanitary control. Cholera infantum, a disease to which young children are particularly susceptible, and which is due to unhealthful surroundings, and unhygienic food and drink, should have a ratio of about 7 per cent. to the total deaths. From 1893 to 1906 the average number of deaths from cholera infantum was twenty out of a total death average of 255, or 8 per cent., but in 1898, the year following the high typhoid fever death rate, the number of deaths from cholera infantum nearly rose to 20 per cent., or three times a reasonable rate.

In diagram 3, the curves of diarrhœa and cholera infantum are repeated to show how closely those curves follow the curve showing the deaths of children under five. This emphasizes the fact that these typical children's diseases, so generally resulting from improper hygienic surroundings, are, therefore, preventable, and that, under sanitary conditions, the number of deaths of children under five might be largely reduced. The present conditions, certainly, are unsatisfactory, and it remains to point out the causes with their approximate remedies.

The natural conditions of the locality are such as to promote rather than destroy health. The city has abundant air spaces, is not congested, and nearly every family lives in a separate house. The greatest density occurs in two places, in Pious Hollow, a settlement of French Canadians on the south side of the river, where 150 persons live on an area of about three acres, or fifty persons per acre — and along Canal street, where about fifty families live in one-story shanties, with few or none of the modern sanitary conveniences. But this congestion is far less than is found in other cities, and noticeable here only because of the high commendable separation of the other houses of the city. Again, the population, while largely French Canadian, contains none of the weaker races of southern Europe, who, oblivious of sanitary requirements, continue such modes of living and unhealthy practices that among them a high death rate is inevitable. The cause for the high death rate must be looked for elsewhere.

Sewers

The city has an adequate sewer system designed to receive both storm water and domestic sewage. There are fourteen separate outlets, discharging into the Oswegatchie river below the intake of the water system, and into the St. Lawrence river. The houses in the settlement known as Pious Hollow are not connected with the system although a lateral is laid in the street. Except for this, there is no evidence or suggestion that the sewers are not well designed, adequate for the purpose intended, and without injurious effect on the health of the community.

* * *

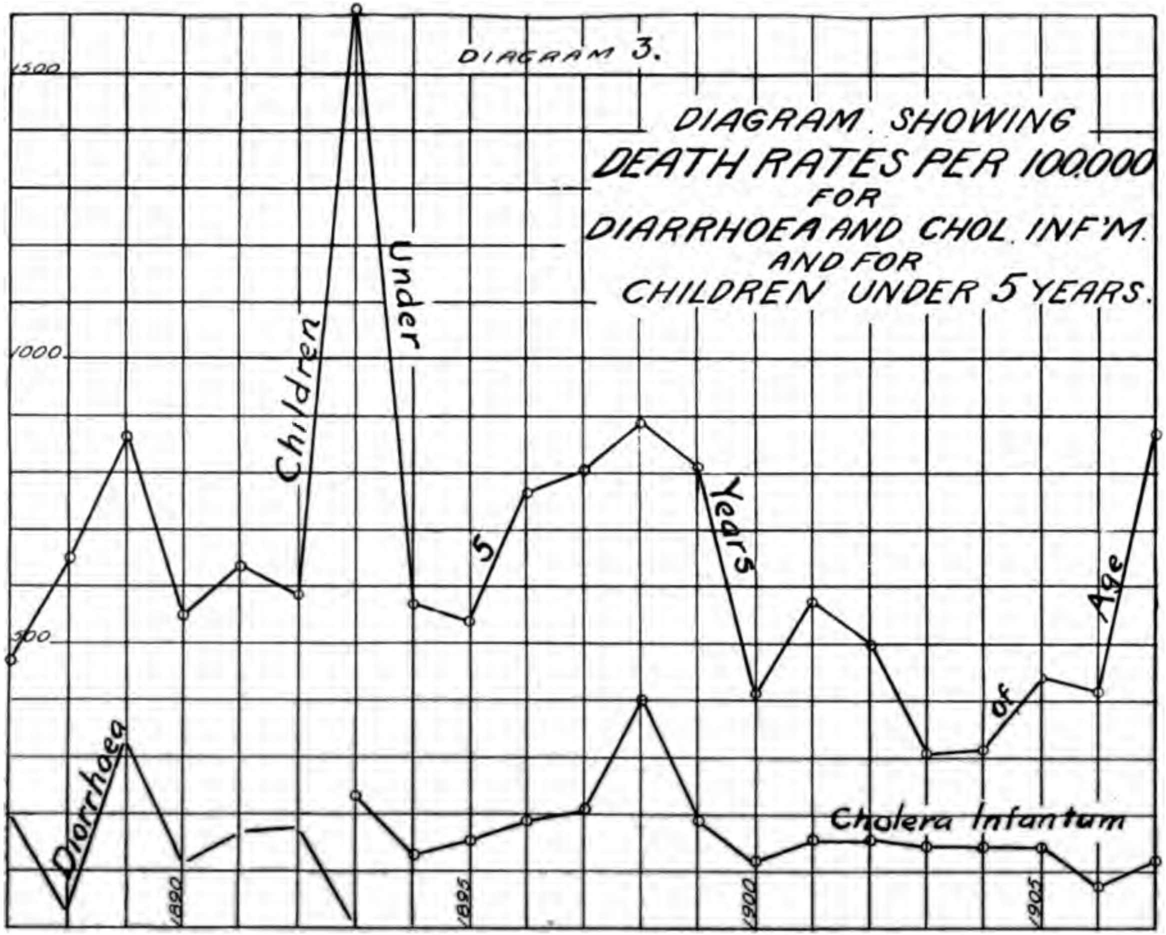


DIAGRAM 3.
DIAGRAM SHOWING
DEATH RATES PER 100,000
FOR
DIARRHOEA AND CHOL. INF'M.
AND FOR
CHILDREN UNDER 5 YEARS.
1500
1000
500
Children Under 5 Years of Age
Diarrhoea
Cholera Infantum
1890
1895
1900
1905

Ice

The ice for the city is cut from the St. Lawrence by three companies, their combined delivery being about thirty tons per day. The St. Lawrence Ice Company, the largest of the three companies, cuts about 4,000 tons annually and their field is about one mile above Ogdensburg and 1,500 feet from shore. Joseph McConville cuts about 2,000, his field being up stream from that of the St. Lawrence Company. David McCormick cuts about the same amount, 2,000 tons, from a field west of Light House Point in the slack water found there.

The locations of the ice fields of the St. Lawrence Ice Company and of Joseph McConville with respect to possible sewage pollution are such as to render the ice harvested from them above suspicion of possible infection. With the McCormick field, however, its location is unfortunately just below the city garbage dump and in time of freshet the field would be subject to surface water from the dump. This field would also be subject to the pollution of that part of the city draining into this portion of the St. Lawrence river.

The dangers from ice infection, though depending upon many factors of a positive and counteracting nature, are greater in proportion to the proximity of the ice fields to the source of contamination. With fields located close to contaminating influences it is quite possible, notwithstanding the protective measures of freezing, for particles of fecal matter containing typhoid bacilli to float upon or be caught and retained in the frozen ice and become vehicles of disease transmission. This influence was clearly described in an account of the epidemic of typhoid fever at the State Hospital in the year 1903, and judging from the location and conditions surrounding the ice field of David McCormick, it is quite possible that ice taken from this source may be a source of typhoid fever infection and add its increment to the total prevalence of this disease in Ogdensburg.

Milk Supply

The milk supply of the city comes from a large number of venders, the total number of cows reported, 650, being divided among thirty-five dealers. The State Hospital has its own herd of 250 cows. In July, 1906, the local board of health passed an ordinance prohibiting any person from selling milk from any cow unless such cow has been inspected by the board of health, and a certificate that the cow is free from disease, and the premises in good sanitary condition, has been issued. Provision for monthly inspection is made, and for the revoking of the license if conditions become unsatisfactory. There is no evidence to show that the local board are not conscientious in their duty, and, therefore, it is more than probable that the milk supply is good and wholesome, and the herds carefully inspected. The large number of dealers makes the possibility of any generally or long continued epidemic from infected milk very unlikely.

Garbage Disposal

The garbage of the city is not cared for in a modern or approved manner. The primitive method of dumping ashes and garbage together in a pile at the back of the house is followed. In the early spring, or at any time when the pile gets too big, it is carted away. No objection can be made to this temporary storage, provided the pile does not emit an odor, and become a public nuisance, but there is serious objection to removing these piles and dumping them onto the bank of the St. Lawrence river, just above the ice field near Light House Point. It is not likely that any disease or unhealthy conditions will arise from the present method of disposing of the garbage, but both the collection and disposal are ineffective and primitive, and should be modified and improved.

Pavements

The former department of public works in the city had charge of the streets, pavements and sidewalks, and was active in carrying forward municipal improvements. Except for three blocks of brick pavement on Ford street, and one block of stone pavement, the streets are macadamized and generally in good condition. The city owns two rock crushers, with the necessary appurtenances, and is thus prepared to improve the street surface at a reasonable cost. There are certainly no bad effects to be apprehended from the present condition of the paving, and while on a few of the streets the surface is not suitable, in general it is most economical and appropriate. The cleanliness of the streets does not seem to be so carefully considered as the maintenance of the surface itself. The streets are generally dirty, especially the stone pavements. The result of the neglect is probably not serious, so far as the health of the community is concerned, but it is rather an annoyance and source of discomfort. The stone pavement area is about 3,000 square yards, and two cubic yards of dust and dirt are collected at each sweeping. The brick pavement area is about 5,834 square yards, and with a daily cleaning nine and four-tenths cubic yards of sweepings are collected each week.

The macadam pavement is cleaned once each month, the area being about 233,000 square yards, from which about 250 cubic yards are taken each month. The sweepings themselves are dumped in the western part of the city, thereby filling up low land.

Water Supply

Ogdensburg began the installation of its present system of water works in 1868, completing ten miles of mains by 1870 and eleven miles by 1873. The source of supply was the Oswegatchie river, the intake being upstream a few hundred feet from the main street of the village. In 1873 an auxiliary 120-horsepower steam pump was installed to be used in times of low water when the turbines were not sufficient. Since then additional laterals have been laid, and in 1898 a 5,000,000-gallon water-power pump and a 6,000,000-gallon steam-power pump were installed to bring the capacity of the station up to the demands. The present mains and laterals represent about twenty-eight miles of piping and the station equipment consists of two forty-eight-inch Victor turbine wheels driving a power pump of 5,000,000 gallons capacity per twenty-four hours, one (old) 3,000,000-gallon pump, at present dismantled, and one Snow duplex triple expansion condensing pumping engine of 6,000,000 gallons, with two 125-horsepower boilers and the necessary accessories of air pumps, feed pumps, etc.

It is evident that the equipment is modern and of ample, if not extravagant, capacity for a city of 13,000 persons, practically the whole city being accessible to water privileges. According to the report made in 1907 the water works department is in good condition financially. The receipts from the department are sufficient to pay all running expenses, to make necessary additions, to pay interest in bonded indebtedness and to retire a certain number of bonds ($10,000) each year. The net income in 1907 was about $3,000, and this is obtained despite low flat rates of from $10 to $15 for dwelling-houses and with all city departments furnished with free water. There are at present two intakes on the intake pipe which extends upstream from the pumping station about 600 feet to a point under the La Fayette street bridge, a half mile below the city line, one opening at the end of the bridge and one directly in front of the pump well. Figure I is a sketch map giving directly the relation of cemeteries and houses to the intakes. About a mile beyond the city line on both sides of the river are large cemeteries — the city cemetery and St. Mary's cemetery on the east and the French cemetery on the west. The cemetery areas are underdrained to the river and organic pollution from the 4,000 graves probably reaches the river. The inspector describes the conditions as follows:

"During the inspection a heavy rain was falling and a gray, foul-smelling sludge floated on the surface of the river, being emitted by these drains. I paddled a boat up the river, and the water near the intake was so foul appearing that I would not care to swim in it, to say nothing of drinking it."

About five miles above Ogdensburg, is Heuvelton, a village consisting of a sawmill, a hotel and a dozen houses — perhaps a population of 100 people. A large part of the sewage from this village finds its way directly into the Oswegatchie. It is more than possible that the river water is there inoculated with bacteria from intestinal discharges which find their way into the water.

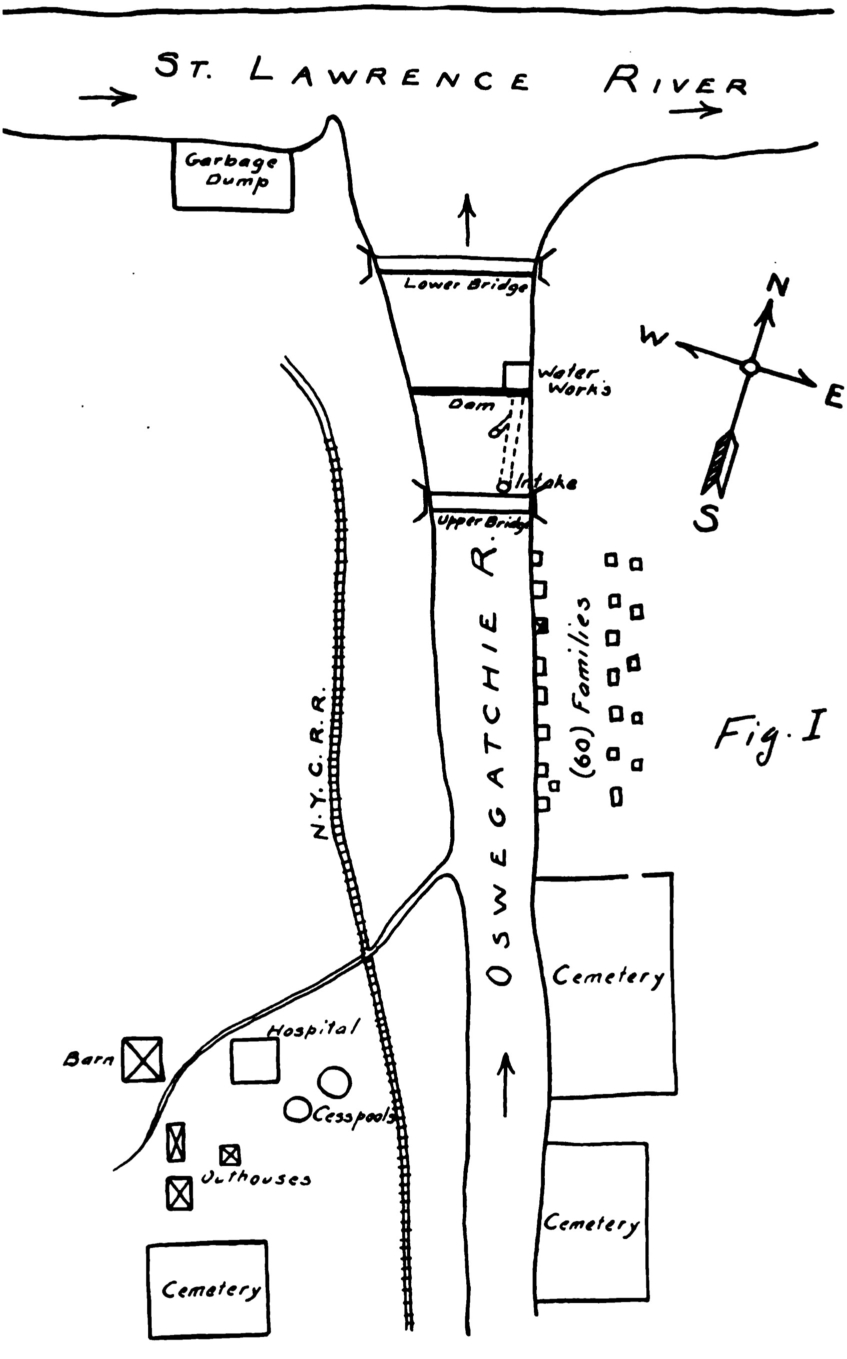

St. Lawrence River
Garbage Dump
Lower Bridge
Water Works
Dam
Intake
Upper Bridge
N
W
E
S
Oswegatchie R.
(60) Families
N.Y.C.R.R.
Cemetery
Hospital
Barn
Cesspools
Outhouses
Cemetery
Cemetery

Fig. I

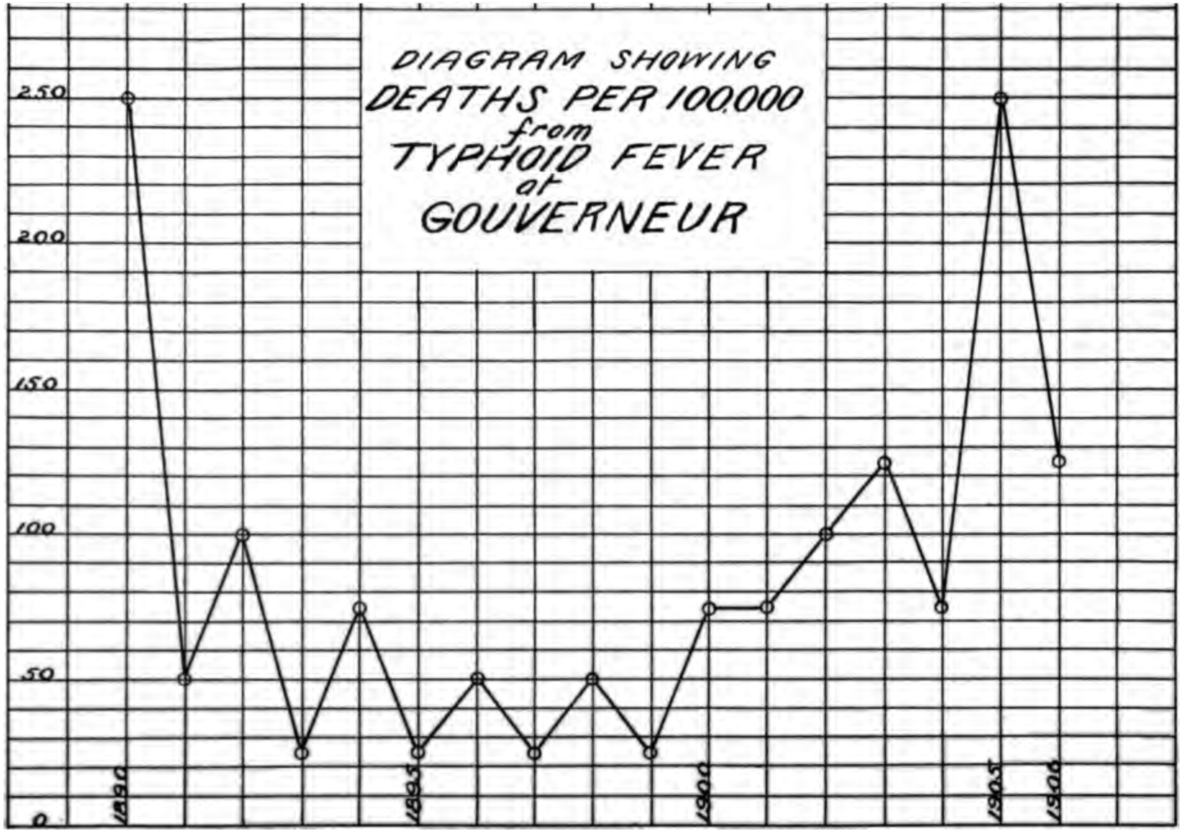


DIAGRAM SHOWING
DEATHS PER 100,000
from
TYPHOID FEVER
at
GOUVERNEUR
250
200
150
100
50
0
1890
1895
1900
1905
1906

Heuvelton, Rensselaer, De Kalb and Wegatchie are all small villages on the river, each place adding to the contamination of the water. About forty-five miles above Ogdensburg is Gouverneur, a place of about 4,000 persons, with a sewer system which discharges directly into the river. Typhoid fever seems to be prevalent in Gouverneur, the death rates running from 25 to 250, as shown by diagram No. 4, so that there must be a continuous discharge of intestinal bacteria.

The fact of the probable pollution of the immediate vicinity of the Ogdensburg intake, the fact that there are a number of small villages contaminating the water upstream from the intake, and the fact that there is a continuous discharge of intestinal bacteria from the sewer of Gouverneur, where typhoid is prevalent, account fully for the high death rates from intestinal diseases already pointed out. A great deal has been said in years past about the sawdust nuisance and the difficulties involved in pumping and distributing sawdust polluted water. But the danger from sawdust is infinitesimal as compared with that from bacterial pollution. It is not too much to say that the continued use of the present water supply in its present condition is an act which the water commissioners should not permit and which the citizens of Ogdensburg should not acquiesce in.

It has been reported that there exists in the city of Ogdensburg a large number of wells. Concerning these wells I find a report by Mr. James T. Gardner is to be found in the Fifth Annual Report of the State Board of Health for the year 1885 which throws considerable light upon this question.

It appears that in the earlier days of the city there were undoubtedly a large number of wells estimated by Mr. Gardner to supply one-half of the people when the population was 10,000. To-day, with a population of 13,000, the water works superintendent reports 11,000 consumers of public supply, with 1,600 consumers from private sources, that is, the per cent. of the population using city water has rapidly increased, while the per cent. using well water has most decidedly decreased.

Moreover, since 1885, when there existed in Ogdensburg about thirteen miles of water mains, there have been laid 82,000 feet or about sixteen miles additional, or the distribution system has more than doubled, although the population has increased only from 10,000 to 13,000 people. If, therefore, the wells are responsible for the present high typhoid death rate, the decrease in the use of well water and the increase in the use of city water, which is very marked, ought to result in a decrease in the amount of typhoid fever since 1885. This has not been the case, and the statements made in the report are all based on typhoid fever rates during the past twenty years, or since 1887. The curve shown on the diagram submitted does not indicate any gradual reduction of typhoid fever, but rather an increase in the same, and I believe that the facts indicate that while the condition of the subsoil water undoubtedly points to pollution, and while there may exist a certain amount of typhoid fever epidemic in the city, the large typhoid death rate is due to the polluted water of the Oswegatchie river.

As to the number of wells still in use I read in the notes given me by Mr. Robartes as follows: The health officer says that "there used to be many wells in the city, but we have been trying to do away with them as fast as possible, and they are now largely closed." Also that the city clerk says "that the few wells now in existence are used only by the oldest inhabitants who are unwilling to give up the water that they have always used." Also a note which says "the water pipes have been extended to cover practically the entire city, and no section, even where the social conditions are worst, as in Pious Hollow and on the northern outskirts, is without the city water."

Conclusions and Recommendations

1. The history, location, population and character of the city of Ogdensburg should make it one of the healthiest cities of the State.

2. The general death rate in Ogdensburg has been above the average and the death rate from intestinal diseases (diarrhœa and cholera infantum) has been irregular and erratic and generally excessive.

3. The death rate from typhoid fever for the years 1887–1906 was 41.2 per 100,000, or more than double a moderate and reasonable rate.

4. The responsibility for these high death rates does not appear to lie in the quality or control of the milk supply nor in the design, maintenance and extension of the sewer system nor in the quality and extent of the street pavements.

5. The question of garbage disposal is not yet solved satisfactorily, although it is not likely that the present method of dumping on the river bank in itself is either a public nuisance or responsible for any lowering of the health rate.

6. The supply of ice taken from the field directly west of Light House Point may become contaminated and is open to suspicion. The ice cut from it should not be used for cooling water by immersion or in any way whereby the melted ice can communicate contained bacteria. It is possible that this ice is partly responsible for the high death rate in Ogdensburg.

7. The chief reason for the high death rates given in section No. 3 above undoubtedly lies in a polluted water supply, the pollution entering the Oswegatchie at least as far upstream as Gouverneur and continuing down to the very point where the water is taken out of the river.

8. The results of this carelessness and neglect on the part of the citizens of Ogdensburg and of their representatives, who have constituted the water commission, have, according to statistics, been the unnecessary deaths of two persons each year from typhoid fever and probably twenty serious cases of unnecessary illness.

9. In view of the above it is the imperative duty of Ogdensburg to take immediate steps to improve the water supply and to throw off the lethargy which has seemingly enveloped both the citizens and water board alike. There is no question of the high death rate being due almost wholly to the polluted water supply nor is there any question but that the more intelligent citizens are fully alive to the fact. It only remains for the water board to rouse themselves to the needs of the occasion, secure competent engineering advice, and with the utmost diligence and expedition remedy the unfortunate conditions which now obtain.

Respectfully submitted,

H. N. OGDEN,
Special Assistant Engineer

NIAGARA FALLS

ALBANY, N. Y., *December* 4, 1907.

MR. THEODORE HORTON, *Chief Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR:— I beg to submit herewith a report on the sanitary conditions of the city of Niagara Falls, based upon general information and statistics collected by Mr. Robartes, Inspecting Engineer, during his inspection last summer, and the verified statements made to me personally during a later inspection on November 29th:

Introduction

The present city of Niagara Falls lies on the east side of the Niagara river just at the site of the famous waterfall of the same name. The city has an area of about four square miles, and, according to the 1905 State census, a population of 26,560.

Niagara Falls owes its early notoriety in large part to the enthusiastic description of its natural beauty and advantages, as portrayed in Father Hennepin's history of "New Discoveries." This interesting book was published in 1697, and so great was the demand for it that it passed through forty-five editions. This necessarily implied a large circulation in Europe, and it was thus that the scenic grandeur of the falls first became impressed upon Europeans. The eyes of the world are, in a sense, on Niagara Falls, both water and city, and each year thousands of tourists, Baedecker making it 400,000, are subjected to the charms of the one, and the sanitary conditions of the other. It is of peculiar and widespread interest, therefore, to consider the existing sanitary conditions of this city.

History

From an historical standpoint the earliest actual settlement at Niagara Falls dates back to 1678 when La Salle established a trading post at the mouth of the Niagara river, and a second post seven miles upstream, near the present sight of Lewiston. A portage was necessary from Lewiston to a point above the falls, and the upper end of this portage was gradually fortified, constituting the first settlement at the site of the present city. There was no decided growth, however, for many years, since as late as 1750 there were few, if any, habitations besides the actual fortifications. In the French-English war, this fort, then held by the French, who claimed to own the waterways from Montreal to New Orleans, was destroyed by the English, and Captain Schlosser, of the British army, built a new fort named after himself, the ruins of which may yet be seen. After the war of the revolution Fort Niagara was abandoned by the British under the conditions of the treaty of Paris, 1783, though it was one of the last posts so deserted. New York State came then into possession of a strip of land, one mile wide, extending along the entire east bank of the Niagara river, a distance of about thirty-eight miles. A large portion of this, in the vicinity of the falls, was bought by Augustus and Peter Porter and Benjamin Barton, and the heirs of Augustus Porter still hold some of this property. The original owners evidently appreciated the value of the water power, and laid out a village which they named Manchester, and a large number of settlers were attracted. In 1805 the upper raceway was built and shortly after the lower raceway. In 1813, in the war with the English, all the American towns in the vicinity of Niagara were burned by an attacking force, and Fort Niagara, Youngstown, Lewiston, Manchester, Fort Schlosser, Black Rock and Buffalo were wiped out. The war was ended by the treaty of Ghent in 1814, and the history of the village of Niagara Falls proper may be said to date from 1816, when the gristmill was rebuilt. This old gristmill is still standing. In 1847 the first of the series of waterpower developments was undertaken, although the completion of the enterprise and the construction of the first mill were not finished until 1874, about 25,000 horsepower being available from this source. The present prosperity of the city dates from this period, the city up to 1875 having a population of less than 5,000. The hydraulic tunnel, built in 1886, added to the power available, and the recent developments have increased this power to a total of about 200,000 horsepower, the original canal or raceway being still in use.

Topography

The city is built on a table land which extends from Lake Erie to the Queenstown bluff. Below the falls the river forms a deep canyon through this tableland, and for six or seven miles flows at a depth of 260 feet below the level of the city. East of the city the land is generally flat with slight undulations. Both east and south of the city there is practically no surface grade, although within the city both street and sewer grades are ample to carry the water directly into the river.

The rock ledge over which the river plunges is of Niagara limestone, which formation underlies in a horizontal stratum the entire city. Above this is a blanket of glacial drift about fifteen feet in depth, deposited at the time of the ice age.

The industrial nature of Niagara Falls is due to the abundant and cheap waterpower, on account of which manufacturing establishments have sprung up as if by magic within the past ten years. The Niagara Falls Power Company finished its tailrace and installed its generators in 1895, and offered electric power for sale at figures far lower than any at which steam power could be generated. In five years fifteen companies had developed into large establishments, using nearly 10,000 horse power. The first plant of 50,000 horsepower was entirely inadequate for the demands, and the additional power developments have been followed by the construction of new manufacturing plants.

At present a large part of the power is transmitted to Buffalo and Lockport in the immediate vicinity, as well as to Syracuse and intermediate points. But the power used in the city is sufficient to make it pre-eminently a manufacturing city, tenth in rank of all the manufacturing cities of the United States, coming between Albany and Amsterdam. The best known and largest establishments are the Pittsburg Reduction Company, making aluminum; the Natural Food Company, making shredded wheat biscuits; the Acheson Graphite Company, making graphite; the Carborundum Company, making carborundum; the Electric Lead Reduction Company, making litharge; the Mathieson Alkali Works, making chloride of lime and caustic soda; the Union Carbide Company, making the carbide for acetylene gas. Enough has been said, however, to indicate the manufacturing character of the city.

The United States census report of 1900 shows eighty-five corporations or firms established in Niagara Falls, with a capitalization of $27,115,761, the Niagara Falls Power Company being included in this list.

These corporations employ 4,574 wage-earners out of a total population of 19,457. There are 3,996 families, or, every head of a family and 14 per cent. besides, are on the average wage-earners in factories. There is not likely, therefore, to be a majority of persons in the city whose ages are above middle life, but the population rather is a young and active working population. There is, however, no tenement-house congestion. The 3,996 families are housed in 3,705 dwellings, or only 7 per cent. of the families are living with other families. The entire population, 19,457, is located in 3,705 dwellings, or 5.2 persons per house, a moderate and reasonable density. Compare Cohoes, for example, with 23,910 population in 2,968 dwellings, or eight persons per dwelling, or Schenectady, with its population of 31,682 in 4,511 dwellings, viz.: seven persons per dwelling. The statistics of the whole of the United States show 5.3 persons per dwelling, and for New York State, with its large number of cities in which the population is badly congested, 7.0 persons per dwelling. Niagara Falls, by comparison, is fortunate in the number of individual houses and in the moderate number of persons per house. Indeed, one section of the city, Echota, consists of separate workmen's dwellings, specially designed and built so as to attract wage-earners to the city by well-designed, commodious and sanitary houses, built by the manufacturing interests and intended for their employees.

There are a large number of foreigners in the city, which, under certain conditions, would tend to increase the death rate, both on account of the predisposition of certain nations to certain diseases, and on account of the tendency of such foreigners to live in unhealthy, insanitary ways. But the nations represented in Niagara Falls have not any of the characteristics which tend to an increased death rate, as will be evident from the table of population for the county.

Total population in Niagara county, 1900			74,961
Foreign born population			17,691
		Per cent:	
Canadian English	5,734	32.3	
Canadian French	251	1.4	
English	2,158	12.2	
German	5,060	28.6	
Irish	2,336	13.2	
Italian	651	3.7	
Polish German	188	1.1	
Polish Russian	256	1.5	
Scotch	385	2.2	
Scattering	672	3.8	
	17,691	100.0	
			17,691

Forty-four and five-tenth per cent., or nearly half of the foreign population, therefore, are English born, and with the German and Irish born in addition make up 86.3 per cent. of the entire foreign-born population — a condition which does not indicate any tendency to a high death rate on account of the nationality of the population of Niagara Falls, assuming that the same ratios hold for the city as for the county.

Mortality Statistics

In making a study of the mortality statistics confusion is introduced by the fact that, in 1892, the former village of Niagara Falls, together with the village of Suspension Bridge, was incorporated as the city of Niagara Falls. The population curve, to which the number of deaths is referred, is drawn by combining the population of the two villages before 1892, and taking the city population after that date. Similarly, the number of deaths before 1892 are for the two villages combined. On diagram No. 2 are shown the computed death rates per 1,000 for all diseases, and the typhoid fever death rate per 100,000 population: The curve for general death rate shows no abrupt changes, but remains uniformly between 12 and 18 per 1,000, with an average rate of 15.5.

DIAGRAM I.

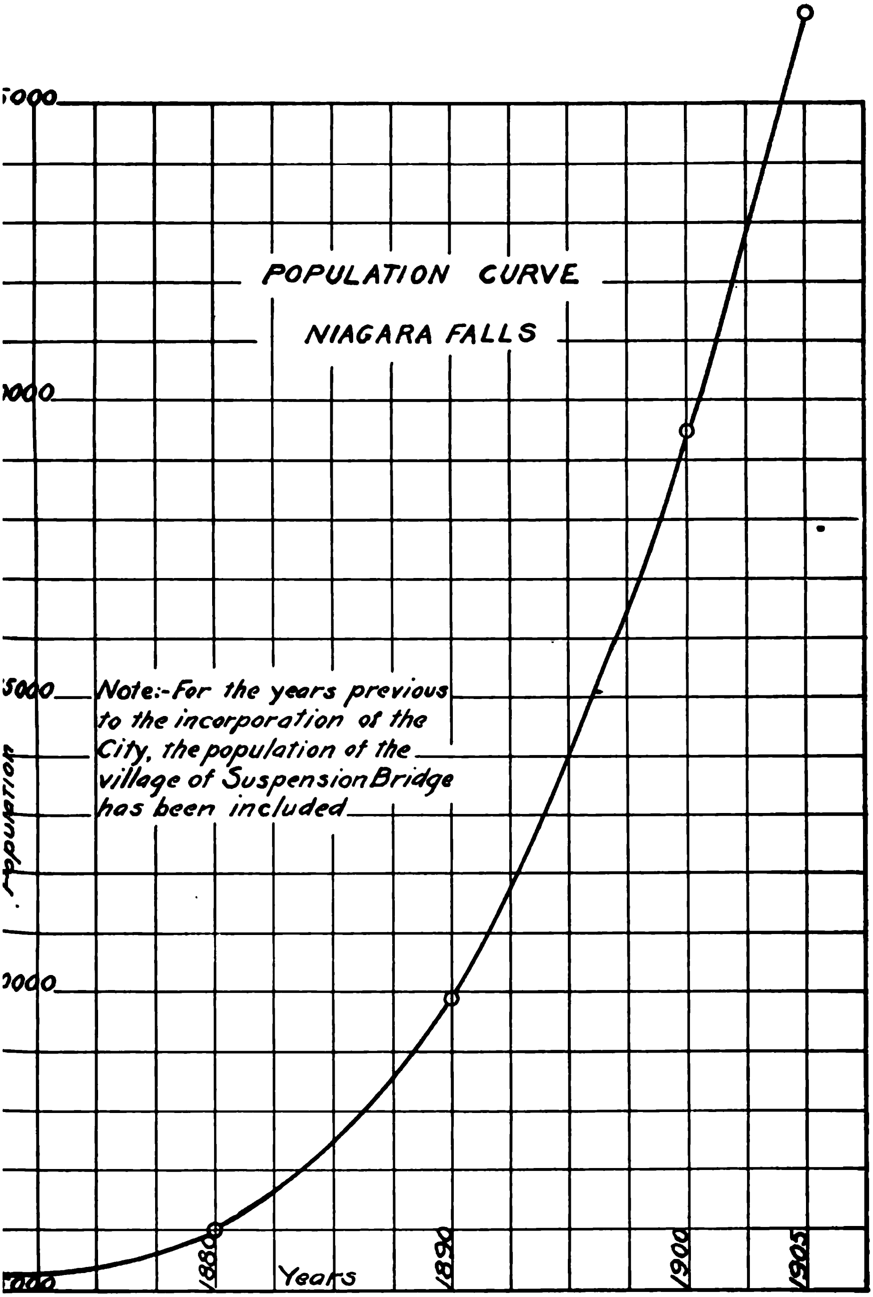
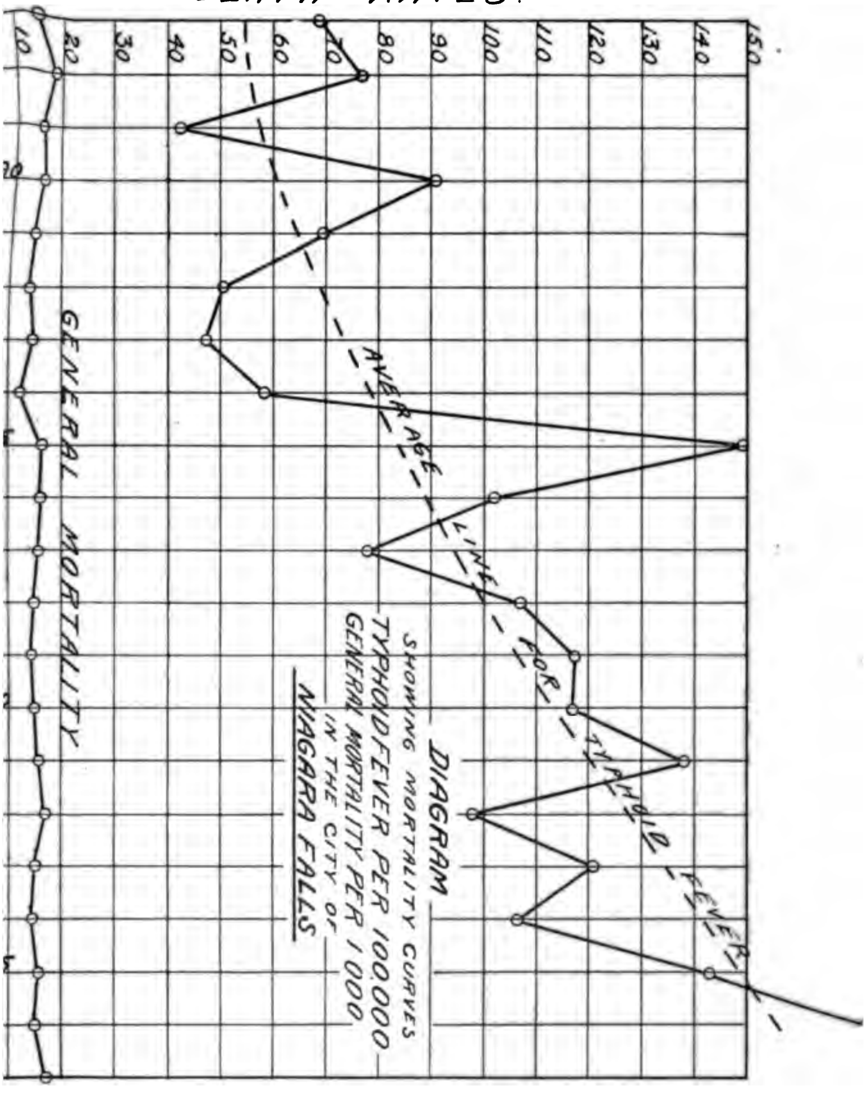

000
000
5000
000
000
Population
POPULATION CURVE
NIAGARA FALLS
Note:-For the years previous to the incorporation of the City, the population of the village of Suspension Bridge has been included
1880
1890
1900
1905
Years

DIAGRAM II.

DEATH RATES.



is lower than the average rate of the State for the past five
viz.— 16.8, and suggests that the health conditions at
ra Falls are better than the average.

the same diagram, however, is shown the curve for typhoid
in deaths per 100,000. This shows a death rate of sixty-
n 1887, and a rate since then which has at no time been less
orty-two, and was as high as 149 in 1895, the average for the
wenty years being 97.7.

Massachusetts, through continued care on the part of the
Board of Health, the typhoid fever death rate remains about
y for all the cities and towns reporting. For example, in
ve years 1899–1904 the death rate decreased from 23.1 to
an unmistakable evidence of the growing appreciation of
cessity for pure waters.

ATH RATE IN MASSACHUSETTS FROM TYPHOID FEVER IN DEATHS PER 100,000.

1899	1900	1901	1902	1903	1904
23.1	22.5	19.6	18.8	18.1	15.9

is comparison is startling, a very strong evidence of the un-
actory condition resulting in such an abnormal typhoid fever
rate as that existing for twenty years past in Niagara Falls.
lifference in the two rates is about eighty per 100,000 or, for
opulation of Niagara Falls, twenty deaths per year as an
ge. In 1906 this number was more than doubled. The
y annual deaths represent 200 cases of serious illness from
or one in every other house in Niagara Falls, some time each

Moreover there are undoubtedly many cases of fever among
ousands of visitors, who carry away with them the germs of
sease, and suffer, and possibly die, in other cities. We must
onsider the sickness and death resulting from the contamina-
which one person, bringing away the germs from Niagara
may transmit to a well or stream. The condition is fright-
ust in itself, and the fact of an average number of twenty
essary deaths each year should be sufficient to arouse our
diate attention.

Again, the health of a community is measured by the number of deaths of children under five, since they are peculiarly susceptible to disturbances in the digestive tract, brought about by polluted water, or by improper food. The ratio of deaths under five to total deaths is, under normal conditions, about 30 per cent., that is, 30 per cent. of all deaths per year are under five years old. In Niagara Falls the average number of deaths per year for the past twenty years has been 258.6 and the number of deaths of children under five 88.5 — a ratio of 34.2 per cent. If these are arranged in five-year periods, the ratio for the first period is thirty-two, for the second thirty-five, for the third thirty-two, and for the fourth thirty-seven, showing that while the normal death rate from all causes is low, the ratio of deaths under five is large, showing an unhealthy condition of the food, milk or water supply, the conditions of housing being satisfactory.

The variation, moreover, is noticeable. In 1894, for example, the ratio was 47 per cent., or nearly half of the entire yearly deaths were of children under five, and that although the typhoid rate for that year was unusually low. In 1905 the ratio was thirty-five and in 1906 was thirty-eight, the conclusion being that some influence is at work which operates to produce an abnormally high death rate among children. The presumption in such a case is that there is supplied an organically polluted water, which, when typhoid fever is not prevalent, or when it is, produces such intestinal disturbances that death results.

The natural conditions are not prejudicial to health. The clay subsoil may increase the amount of dampness in the vicinity of the dwellings, but a complete system of sewers prohibits an excessive amount of such moisture. The city has abundant air spaces, is below the average for the whole of the United States in the number of detached houses per 1,000 population, and in the small number of persons per dwelling. In the fifth ward there are 8,883 persons living on an area of 317 acres or twenty-eight persons per acre. But this is recognized as pre-eminently the most congested part of the city, and this is not to be considered as implying particularly insanitary conditions, since this density if far below 100 persons per acre, a density found in many of the larger cities. The population is sturdy, American, English, Irish, and German, chiefly, and is of the working age when the death rate should be the lowest. The cause for the high typhoid fever death rate must be sought elsewhere.

Sewers

The construction of sewers in Niagara Falls began in 1890, when the place was still a village. Three hundred thousand dollars was then expended, and since then about $650,000 more has been applied to the same purpose. The system is combined, houses and gutters using the same pipes which vary in size from eight inches to eight feet. The outfall pipes, six in number, discharge down the bank of the gorge below the falls. The rapid growth of the city has made it difficult for the sewer extensions to keep pace with the growth, but the area drained by the sewer system is more than half of the area of the city. The built-up portion is well provided for and the suburban portion is being rapidly cared for. There is no evidence or suggestion that the sewers are not well designed, adequate for the purpose intended and without injurious effect on the health of the community. When the industrial village of Echota was laid out, a chemical precipitation plant was designed and built to care for the sewage of that village. In 1904, the main tunnel sewer of the city was extended into Sugar street, and the Echota outfall connected.

Ice

The ice used in Niagara Falls does not come in any case directly from the Niagara river, nor from Lake Ontario, the swift current in the one case, and the distance in the other, preventing. The largest ice company is the Cataract Ice Company, which supplies an artificial product, the water coming from a well and filtered through charcoal and sand. This company distributes about fifty tons of ice daily during the summer.

The Niagara Cold Storage & Ice Company also makes and delivers artificial ice, using city water for the purpose, its capacity being seventeen tons daily. It is said that this ice is only used in coolers, and that no domestic trade is supplied. The Frontier Ice Company, delivering twenty tons, and W. P. Dixon, delivering fifteen tons daily, cut and store natural ice, the former from Chautauqua lake and the latter from a Canadian pond about fifty miles from the border. No analyses are available for any of this ice and no conclusions, therefore, can be drawn. No inspection was made of the Canadian pond and the exact part of Chautauqua lake where the ice-field is located was not ascertained. Ice made from the city water, or from well water, is open to suspicion, and should be further considered unless a satisfactory explanation of the high death rate is found elsewhere.

Milk Supply

Twenty-four dealers are involved in the milk supply, varying in business from the Niagara dairy which distributes and sells 700 gallons daily, to the individual dealer who owns one or two cows and distributes their milk.

The sanitary code of the city is emphatic in its denunciation of impure, watered or unwholesome milk. It forbids any person selling milk in the city if any contagious diseases exist in the family of such person. The character of the milkhouses in the city for the temporary storage and dispensation of the milk is carefully prescribed. All dealers in milk are required to have a license granted by the local board of health and any license so issued may be reissued, or may be revoked, by the board at its discretion. Provision is made for sampling, and standards for butter fat are named.

Every opportunity is, therefore, given for the local board to act, through the health officer, in enforcing a proper standard of cleanliness. Yet the following quotations from the report of the health officer in 1906 indicates that the supervision of the milk supply might be improved:

" During the past year the health officer, with the sanitary inspector, visited the various dairies in the city and investigated the conditions under which our milk was being cared for and handled. The conditions under which some of the milk was being handled were appalling.

"When insanitary conditions were found to exist, the dairymen were immediately notified to correct them in accordance with the rules and regulations of the board of health. The recommendations were in most cases promptly complied with, but in others not so promptly, while others still went out of business rather than comply with our rules and regulations for furnishing their patrons with milk under sanitary conditions.

" The regulations adopted by the board of health for the care and handling of milk within the city are, I believe, very complete and excellent in most respects, but the greatest source of the danger at the present time is in the producer, over whom we have practically no control. The conditions are, to my mind, almost criminal, and yet we found them existing on all sides."

The recommendations of the health officer are that the city establish a municipal dairy in order that proper supervision may be maintained, but it ought to be possible, by a suitable use of the power of the board to revoke the licenses which had been granted, to force all milkmen to deliver milk only from approved dairies, and the effect of prohibiting the delivery of milk obtained from any ill-kept farm would undoubtedly result in a decided improvement in the farm. The conclusion is that, although the power to compel clean dairies exists, it is not freely used, and the high death rate of children may be partly explained by the carelessness of the health board in this regard. In 1906, 164 children died in Niagara Falls, of whom 139 were under one year of age, the total deaths for that year being 430. In percentage the deaths under one were 32.4, and under five, 38.1. A normal rate for deaths under one is 22, and under five, 30 — the deaths under one, therefore, show the higher excess. Another method of testing the sanitary conditions of a community is to refer the number of deaths under one year to the number of births in the same year. In a normally healthy community, the number of deaths under one year should be 150 for each 1,000 births. But in 1905, the last year whose records are available, there were 110 deaths to 556 births, or 198 for each 1,000 births, 32 per cent in excess. This indicates, since milk is the staple article of food for children under one, that the supply is not entirely satisfactory. The figures from Rochester show the effect of a determined attempt to improve the sanitary conditions in the dairies supplying the milk to that city. The figures are taken from the report of the Health Officer above referred to.

DEATH RATE OF CHILDREN UNDER FIVE IN ROCHESTER. ALL CAUSES.

Year.	July.	August.	
1889	151	107	
1890	106	112	
1891	96	110	
1892	127	138	
1893	115	104	
1894	100	101	
1895	108	67	
1896	126	76	
	929	815	1,744
1897	50	57	
1898	58	57	
1899	84	62	
1900	66	68	
1901	49	46	
1902	31	63	
1903	48	50	
1904	26	49	
	412	452	864
			880

" You will see from the above table that the total for the first eight years, and from the total of the second eight years, there is a difference of 880, that means 880 lives saved. This great saving of child life is, without a question of doubt, due to the pure milk furnished for the children, as the other conditions were the same. The death rate would naturally be expected with the growth of the city, so that the saving of these lives is much greater than would at first appear."

Garbage Disposal

The garbage of Niagara Falls is regularly collected under city administration. Collection is made daily from the business section, which is chiefly hotels and restaurants, and every other day from the residence districts. The street department reports 180 loads of 3,500 pounds removed weekly, or about forty-five tons daily, from the population of 26,000 persons. This is certainly ample provision for the removal of household wastes, and should be satisfactory if the collection is made without offense. There have been complaints in the past, and although a city ordinance requires the wagons to be covered, the cover is often a piece of canvas thrown across the wagon box.

The method of disposal is unique. A small house has been built on the bank of the river below the falls. In the floor of the house is a large box, communicating by means of a forty-eight inch C. I. pipe with the waters above the whirlpool rapids. A valve at the top of the pipe allows the box to be filled with water, and the garbage wagons dump their loads directly into the water filled box. At intervals, the valve is opened and the contents discharged into the river below. Connection with the city water system gives good opportunity for flushing, and the discharge into the box of water is supposed to prevent odors. Frequent complaints, however, are received by the local board of health, but the odors from these houses are unbearable, and that the present garbage chutes are a disgrace to a civilized community. Paper, wood and other carbonaceous material is kept separate and burned on the bank of the river by the side of the chute. The ashes are then thrown through the chute into the river. The Department reports fourteen loads of 1,500 pounds of this material collected and burned weekly. Ashes are collected separately once a week in summer and twice a week in winter, the average collection being fifty-four loads of two cubic yards each, weekly. No traces of any of the material is visible in the whirlpool below, and the objection is to the appearance and odor of the dumping chutes. There is no likelihood that these are productive of ill-health or disease and the frequent and large collections must promptly remove all deleterious matter from the houses. The garbage collection, therefore, must be regarded as favorable to the health of the city rather than the reverse.

Pavements

The table following shows the kinds of pavements in use at Niagara Falls, the year built, and the number of square yards in each:

YEAR.	Asphalt.	Brick.	Asphalt blocks.	Macadam.	Bituminous macadam.	Hassam.
1894		6,166				
1895	17,598	14,608				
1896	15,554	14,029				
1897	48,395	311				
1898		1,190				
1899	29,327					
1900	18,045			12,696		
1901	51,409	1,480				
1902	25,085	1,582				
1903	14,971				30,274	
1904	22,764	2,613				
1905						
1906	3,487					
1907	72,234	1,659	41,959	19,267	21,200	11,046

The table shows a large number of square yards of street surface already paved, and an evident and earnest endeavor on the part of the city authorities to keep pace with the growth of the city's population in the increase of pavements. The map attached shows by colors the streets which are paved, and by the key of colors, the kind of pavement may be recognized. All the pavements are in good condition, some of the asphalt being twelve years old, and now at the age when the effect of poor construction should be seen. The brick is in good condition, even that laid in 1894, and the bitulithic is so recently laid that it is in admirable condition. No possible connection can exist between the pavements and the high death rate. Indeed, the city is to be commended for its activity in this direction.

The same commendation should be applied to the street cleaning. The brick and asphalt streets are flushed or washed daily or semi-weekly, besides being swept daily. Twenty men are continually employed in cleaning and washing, and ten wagon-loads of refuse are removed daily, and used for filling in vacant lots. The result is unqualifiedly to have the city unusually clean, a condition which should tend to reduce the mortality.

Water Supply.

The citizens of Niagara Falls have two sources of water supply available, viz.: the municipal supply, and the supply of the Niagara Falls Water Works Company, a private corporation. The former supplies the northern portion, together with the former village of Suspension Bridge, and the latter supplies the southern and business portion of the city. The municipal supply is taken from the hydraulic canal and was inaugurated by the village of Suspension Bridge in 1876. The total cost of works to date is about $350,000 with a bonded debt of $189,500. Direct pressure is maintained by one 5,000,000 Gaskill water power pump, one 1,500,000 Holly water power pump, two 5,000,000 turbines and two 5,500,000 turbines, one 2,000,000 Worthington steam pump, one 1,500,000 Knowles steam pump — the two latter being reserve pumps.

The average daily consumption is about 6,000,000 gallons, or about 500 gallons per head per day, an extraordinary large amount. A rectangular well 24 by 24 feet by the side of the canal receives the water direct whence it is pumped into the mains against an average pressure of sixty pounds. This well is cleaned out every three months, about 1,000 cubic feet being removed. It is said that the stench from the well at such times is unbearable.

The private supply is taken from the same canal above the city station, the well being eight feet square. From the well it passes to a settling basin elevated by two 6,000,000 pumps. Thence it passes to a battery of nine Morrison-Jewell mechanical filters, thirteen feet in diameter and ten feet deep. The water then flows by gravity to a pump well from which it is lifted by two 6,000,000 gallon Riedler hydraulic mine pumps in the power-house of the Niagara Falls Power Company, into a 750,000 gallon standpipe. The power company formerly controlled a majority of the stock of the water company and the late vice-president of the power company was also president of the water company. Recently the property has passed into the control of the Western New York Water Company, a corporation holding and operating a number of water-plants. The consumption is about 7,000,000 gallons per day, a large part being used by factories and railroads. The filters are of the old type with mechanical agitators, the amount of coagulant being regulated by the superintendent, who states that the average is 250 pounds per day, oi, for 7,000,000 gallons, about 0.25 grains per gallon.

No attempt has been made to consider the effect of the two waters on the health of the city separately, although by a study of the location of the individual cases this might be done. The chemical analyses of the raw water show little difference in the amount of organic matter and it is probable that the effect of the filters is chiefly to remove the matters in suspension.

The conditions under which the water of both supplies is taken is not favorable to a low death rate. Sixteen miles upstream is the city of Buffalo, with a population of 376,000, discharging its sewage unpurified into the stream, about 140,000,000 gallons of domestic sewage per day. This sewage carries with it the germs of infectious diseases which in the rapid flow of the river are brought down to Niagara Falls in a few hours. Diagram III shows the typhoid fever rate in Buffalo for seventeen years, ranging between twenty-four in 1904 to sixty-three in 1894. This rate is continually above the normal, and is a manifest reason why the consumption in Niagara Falls of water polluted by the sewage of Buffalo leads to a continuous epidemic of typhoid fever. The intake for the Buffalo water is in the Niagara river, but above the sewage of Buffalo, and the diagram indicates the quality of the water of the Niagara river at its best. The minimum flow of the river is put by the International Waterways Commission at 153,200 cubic feet per second, of which 69 per cent. follows down the western side of Grand island and 31 per cent. down the eastern side. The minimum flow, therefore, available for dilution is 47,492 cubic feet while the sewage flow is 216 cubic feet per second, a dilution of about 200. There is no question, therefore, of any public nuisance committed by the city of Buffalo, and since the city of Buffalo has had its sewers in use since 1845, there is no legal way, under the Public Health Law, of curtailing their present method of sewage disposal. About ten miles above Niagara Falls are the cities of Tonawanda and North Tonawanda, with a combined population of 18,000. The sewage from these two cities also discharges into the river at the mouth of

Diagram III.

DEATH RATES

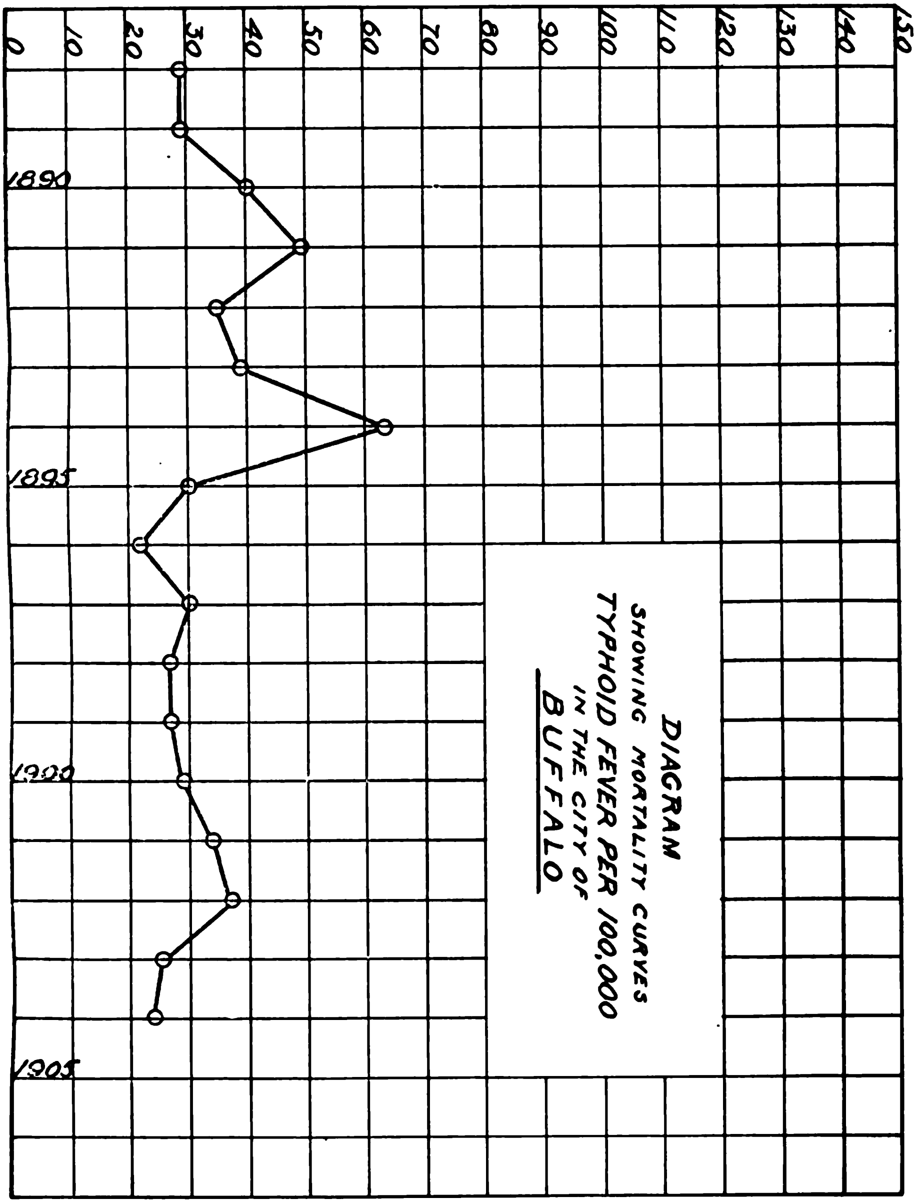


DIAGRAM IV.

DEATH RATES

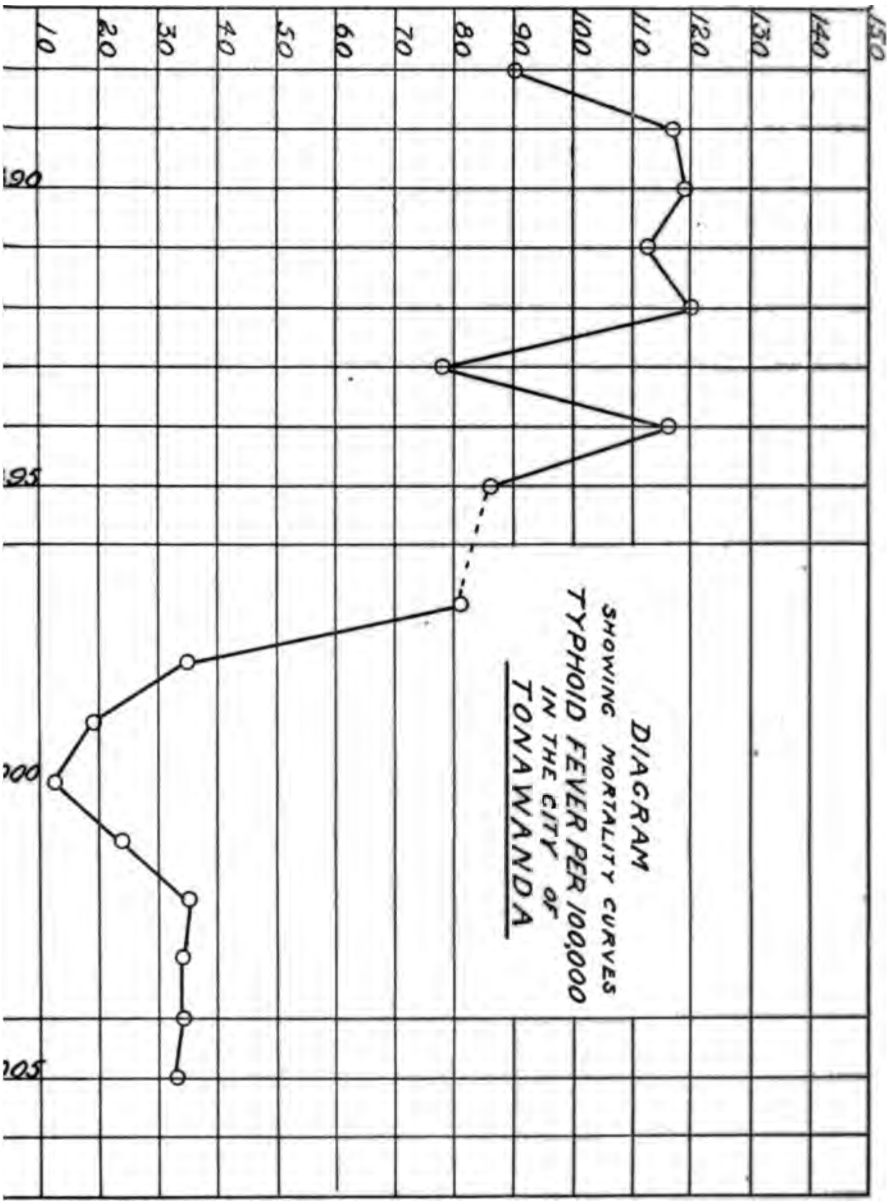
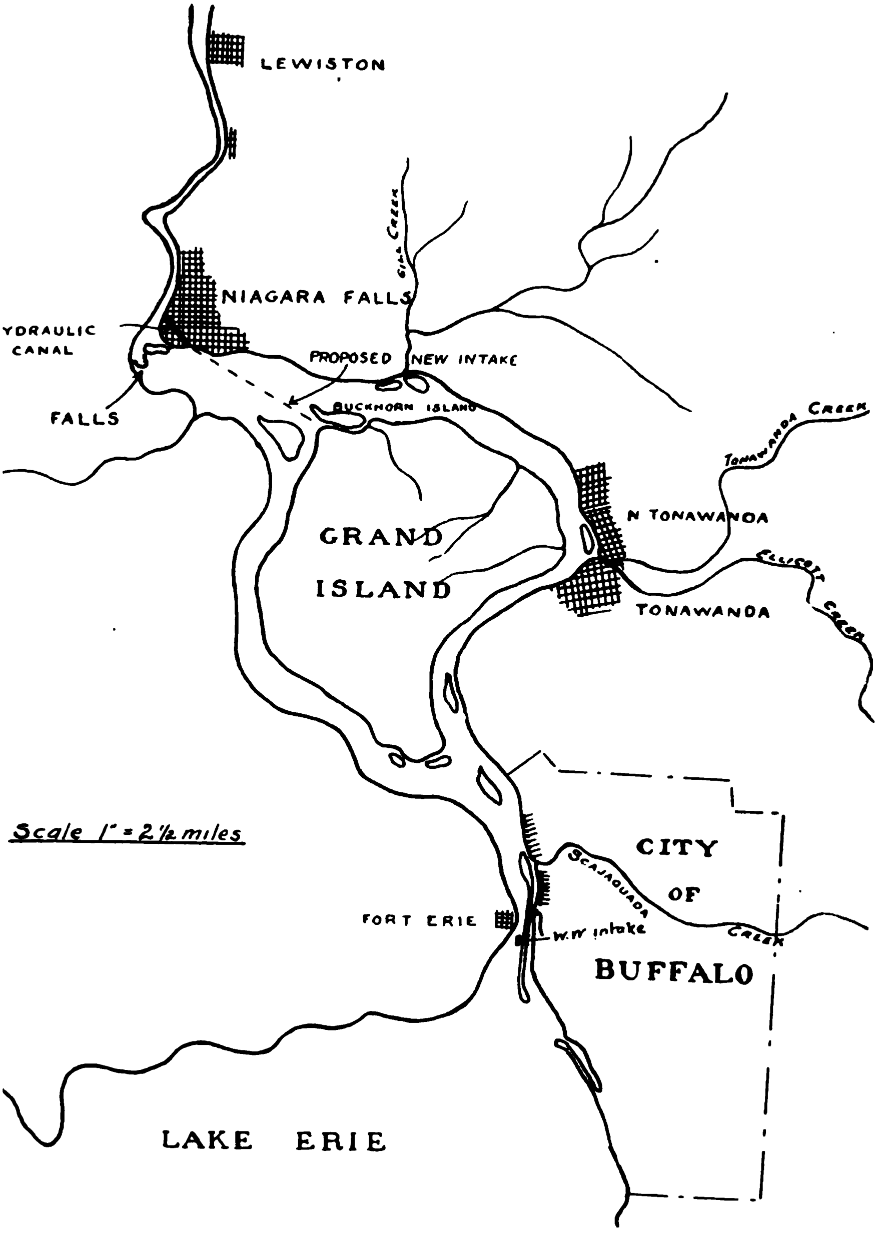


DIAGRAM V.


LEWISTON
GILL CREEK
NIAGARA FALLS
YDRAULIC CANAL
PROPOSED
NEW INTAKE
FALLS
BUCKHORN ISLAND
TONAWANDA CREEK
N TONAWANDA
GRAND ISLAND
ELLICOTT CREEK
TONAWANDA
Scale 1" = 2½ miles
CITY OF BUFFALO
SCAJAQUADA CREEK
FORT ERIE
W.W intake
LAKE ERIE

Tonawanda creek. Diagram IV shows the typhoid fever death rate for the two cities, their water supply coming from the extreme western side of the channel, and, therefore, out of the concentrated pollution. There is shown, however, a continuously high death rate from typhoid fever which must mean a continual discharge of typhoid fever germs into the river by means of the sewers. The flow of the river is such. that there is little commingling of the sewage with the river water but the sewage flow follows down, hugging the north and east banks of the river. Bacteriological analyses made by Dr. Bissel in 1904 substantiate this recognized fact very plainly. A series of counts at Buckhorn island show 800 bacteria per c. c.; 300 yards from the American shore the count was 860 bacteria. One hundred yards from shore the count was 10,000 bacteria, and directly off shore there were too many to count.

Financially the city water works is abundantly able to improve the present conditions.

According to the report of the water works superintendent, Mr. W. J. Callahan, the profit for the year ending June 1, 1907, was $21,453.06, as follows:

Total receipts		$51,615 95
Total current expenses	$18,860 13	
Extension of water mains	11,302 76	
		30,162 89
Profit		$21,453 06

From this the interest on the bonded debt of $189,500, or at 4 per cent., $7,870 must be paid, showing a net profit of about $14,000, sufficient to pay interest at 4 per cent. on $350,000.

In a message of the mayor of Niagara Falls, Mr. A. C. Douglass, dated June 18, 1907, to the board of public works, he discusses the question of providing the city with a better supply and shows that the present income of the city water works is sufficient to pay the running expenses of the water department and the interest on a bond issue of $425,000 which he proposes to expend in improving the water supply. It is not within the scope of the present report to discuss the propriety of his plan for such improvement, but it is evident from his message and from the figures given above that there is no financial reason why such improvements are not made.

Summary

1. Neither the history and location of Niagara Falls nor the social and industrial characteristics of its people offer any indication of insanitary conditions in the city.
2. The general death rate in Niagara Falls is below the average for the State, showing that the general health of the community is good and particularly that the age, nationality, housing and industrial conditions are such as naturally to produce an exceptionally healthy city.
3. The death rate of children under five years old has been abnormally high, being 13 per cent. in excess of the normal for the average of the past twenty years, 23 per cent. in excess for the past five years and 57 per cent. in excess for the year 1906.
4. The average death rate from typhoid fever for the years 1888–1906 was 97.7 per 100,000 population, or five times a moderate and reasonable rate.
5. The responsibility for these high death rates does not appear to lie in the design, maintenance and extension of the sewer system nor in the quality and extent of the street pavements.
6. The propriety of the present method of garbage disposal may be criticized upon æsthetic grounds, but it appears that the garbage is regularly and systematically collected and disposed of in such a way as to prevent its being in any way a menace to the health of the city.
7. The artificial ice made in the city is probably contaminated, but it is not possible to definitely fix the responsibility for typhoid fever on the ice, separately from the city water from which the ice is made. No information is available as to the natural ice used.
8. The milk supply, in view of the number of deaths of children under one year, is not satisfactory from a sanitary stand-

point, when tested either by the ratio of such deaths to total deaths or to total births. This accounts for the excessive number of deaths under five, but not for the high typhoid fever rate to which disease children are not susceptible.

9. The chief reason for the high typhoid fever death rate undoubtedly lies in a polluted water supply, the pollution entering Niagara river from Buffalo and the Tonawandas, where continuously high death rates from typhoid fever exists, and where typhoid fever germs are undoubtedly being continually discharged into the river in the sewage of those cities.

The results of this pollution and of the patient acceptance of this polluted water as a domestic supply, on the part of the citizens of Niagara Falls and of their representatives who have constituted the water board have been, in the last five years, the apparently unnecessary deaths of twenty persons annually from typhoid fever, and probably 200 serious cases of unnecessary illness.

11. In view of the above, it is the imperative duty of Niagara Falls to take immediate steps to improve its water supply, and to throw off the indifference which has characterized it in this matter. There is no question of the high death rate being due almost wholly to the polluted water supply. Nor is there any question but that the mayor and the more intelligent citizens are fully alive to the fact. It only remains for the water board to adopt a properly devised plan for securing a pure water supply, either from a new source or by a filtration of the present supply, which will give water of a purity such that the typhoid fever death rate will be reduced from ninety-eight to a normal figure comparable to the best supplies of the State.

Respectfully submitted,

H. N. OGDEN,
Special Assistant Engineer

POUGHKEEPSIE

ALBANY, N. Y., *December* 15, 1907.

MR. THEODORE HORTON, *Chief Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR:— I have the honor to transmit herewith my report on the sanitary condition of the city of Poughkeepsie:

History

The early history of the present city of Poughkeepsie begins with the early settlement of this country. In 1686, under the patents of Saunders and Harmans, the first settlement was made at the present site of the city, the immediate attraction to the locality being the excellent mill sites on the river front at the mouth of the Fallkill. These early patentees divided their lands into village plots reaching back into the comparatively level tract above the river, and this level tract was the site of the first settlement, rather than the shore of the river, the early construction of the Albany post road through this portion of the town diverting and concentrating the improvement in this part.

A census in 1714 shows 445 persons residing in the village, and in 1718 the first Dutch church was erected. In 1756 the population had reached 14,000, and in 1776 the population was 22,000, the largest village in the State outside of New York city. The State Legislature met in this city in 1777, and after the Revolution, the Legislature returned and held its sessions there. The first Constitutional Convention of the State was held in Poughkeepsie. It was incorporated as a village in 1799, the boundaries of the village being identical with the present boundaries of the city. After 1800 a rapid development took place; the Booth woolen mill, the Eagle cotton factories, the Vassar brewery, a library, a bank, and a theater being all built before 1812. In 1830 an improvement party undertook to develop the city, and a large amount of money was expended in opening and developing new streets, in the construction of a reservoir, in the placing of fire hydrants, and in the general development of a water system from Fallkill. The inauguration of railroad traffic on the Hudson River railroad in 1849 increased the business of the city largely, and the population reacted by a marked increase also. A city charter was granted in 1854 and the majority of the present manufacturing establishments were started in that decade.

The establishment of Vassar College in 1861 was followed by the establishment of a number of private schools in the city, the population thus added to the city being estimated to-day at about 3,000 or about one-eighth of the entire city population. The State hospital was established in 1872, its location being about one-half mile north of the city, and in 1886 the railroad bridge across the Hudson was built to form a connection between New England and the west.

The city thus shows a steady and continual growth from its earliest days to the present, and its long history is in marked contrast to the cities of the northern and central part of the State, all of which are less than 100 years old.

Topography

The ground on which the city is built rises from the river bank to an area nearly level, about 100 feet above the level of the river, and 1,500 feet back or on a slope of about one foot in fifteen feet. Beyond this the ground is nearly level, broken on the northeast by the Fallkill creek, which runs along the northern part of the city and empties into the Hudson. On the southeast is found the headwaters of a branch of the Casper creek, the ground between on the east sloping down to the main line of the same creek. The surface drainage is, therefore, ample, and there are, in most part, good grades for sewage and storm water.

Sociology

In the value of manufactured products, the city ranks as twenty-second in the State, coming between Kingston and Elmira. According to the United States census of 1900, there is $5,688,000 invested in factories and shops in the city and there are, out of a population of 24,000, 3,432 wage-earners who receive an average annual amount of $461. These wage-earners are distributed among 377 establishments, or nine employees per establishment.

This includes all the small establishments such as millinery shops, planing mills, machine shops and all the other small places necessary for the city's existence. Poughkeepsie is, therefore, not essentially a manufacturing city.

There were 4,010 dwellings in the city by the 1900 census, or six persons per dwelling. The statistics of the whole of the United States show 5.3 persons per dwelling and of New York State, with its large number of cities in which the population is badly congested, 7.0 persons per dwelling. Poughkeepsie is, therefore, in its average density of population, above the average density of population for the United States, but below the average for New York State.

On an area running back from the river about one-half mile, between Duckers avenue on the north and Pine street on the south, an area of about 200 acres, are estimated to be 10,000 people of the laboring class, many colored and foreign population being included. This is a density of fifty per acre, showing a congested condition in this locality. In ordinary residential communities the density of population is about thirty per acre, and reaches sixty to eighty in continuous city blocks. For the class of population described above, there is undoubtedly overcrowding in this district, which tends to increase the death rate.

In 1900, there were included in the 24,029 population, 3,998 foreign-born whites and 632 colored persons in Poughkeepsie, or about one-half of this congested population if they all lived in this one part of the city. Probably a large part of them do, and on account of the lack of knowledge of sanitary matters, and the unwillingness of this class to take sanitary precautions, the local death rate in this locality is probably high. The foreign-born population, however, is of good origin, three-quarters being English, Irish and German.

The population curve in Diagram No. 1 shows a uniform and steady increase and the physical conditions of the site as well as the social conditions of the people give no indication that the city is out of the ordinary in its sanitary condition.

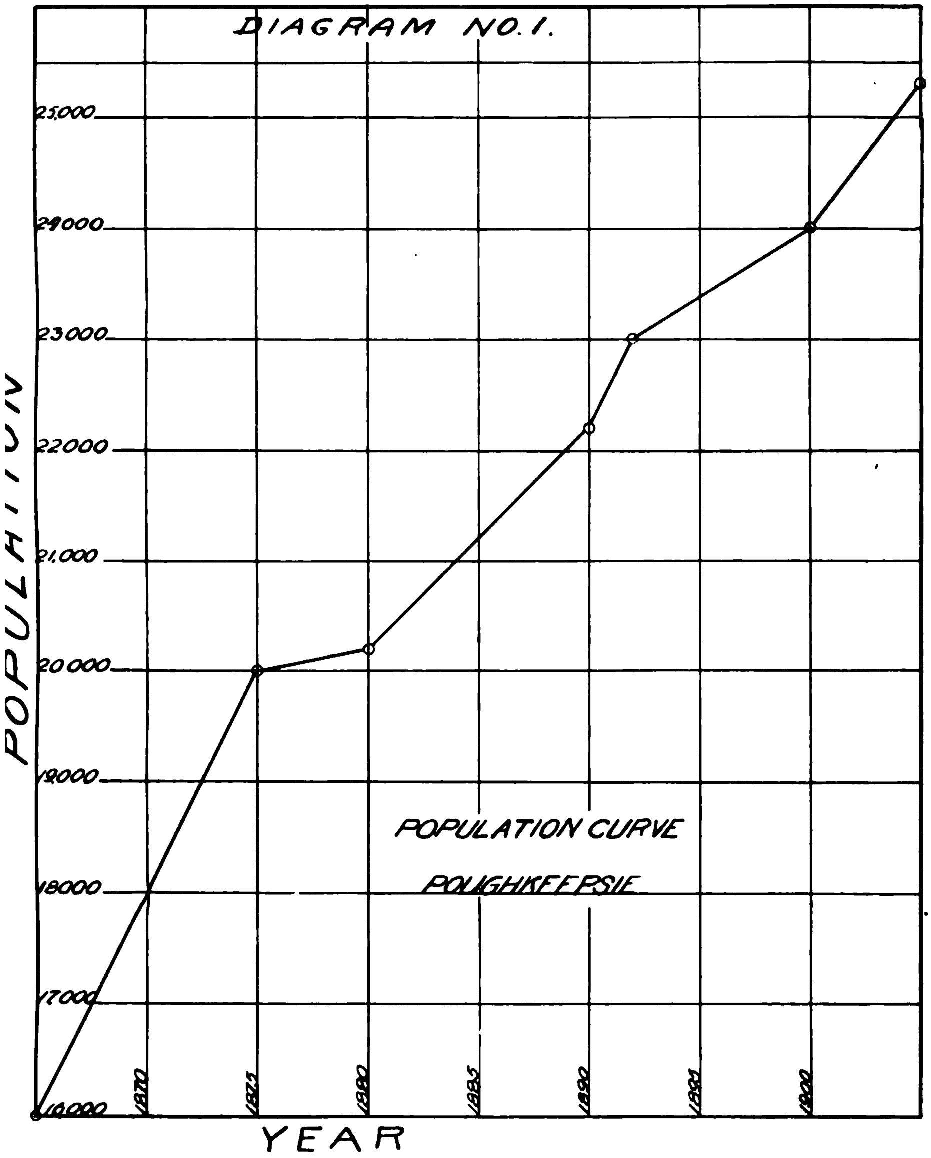


DIAGRAM NO. 1.
POPULATION
YEAR
25,000
24000
23000
22000
21,000
20,000
19000
18000
17000
16000
1870
1875
1880
1885
1890
1895
1900
POPULATION CURVE
POUGHKEEPSIE

DIAGRAM No. 2.

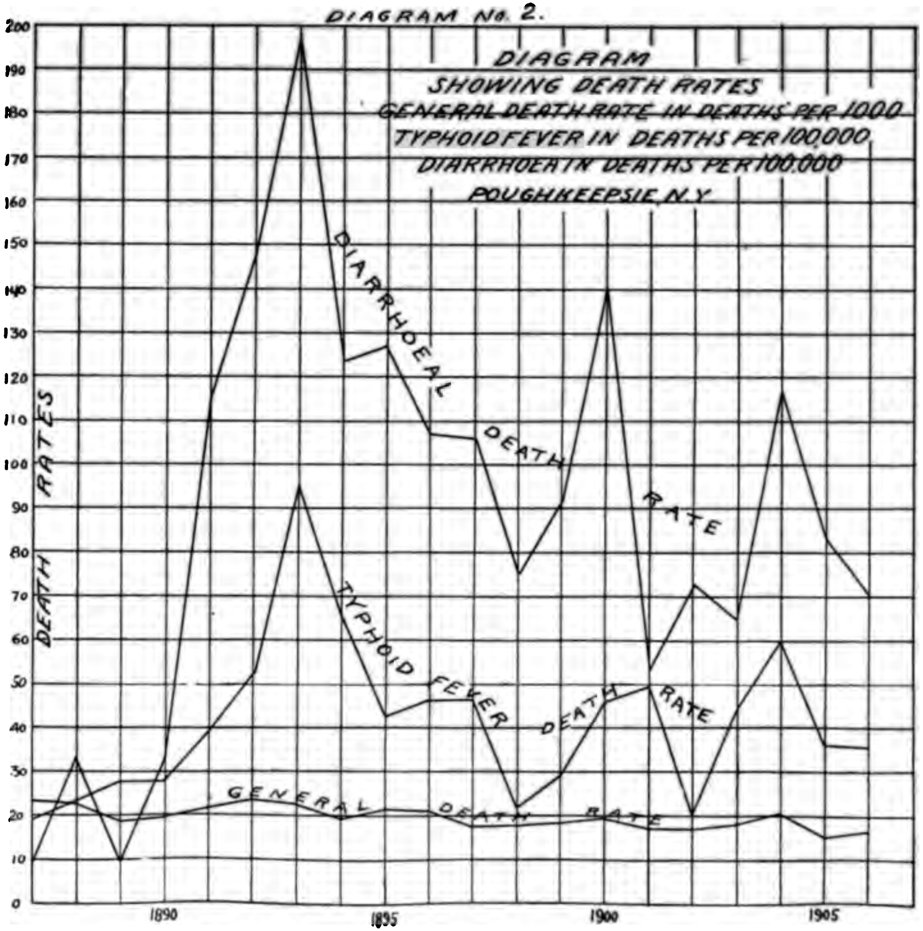


DIAGRAM
SHOWING DEATH RATES
GENERAL DEATH RATE IN DEATHS PER 1000
TYPHOID FEVER IN DEATHS PER 100,000
DIARRHOEA IN DEATHS PER 100,000
POUGHKEEPSIE, N.Y.
DEATH RATES
DIARRHOEAL DEATH RATE
TYPHOID FEVER DEATH RATE
GENERAL DEATH RATE
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1890
1895
1900
1905

Mortality Statistics

e general death rate of the city for the past twenty years is
ı in the following table and in Diagram No. 2:

YEAR.	General.	Under five.	Cholera infantum.	Diarrhea.	Typhoid.
	425	132	5	......	5
	502	162	9	......	5
	417	101	......	1	[illegible]
	429	106	13	7	[illegible]
	493	143	10	26	9
	537	166	8	34	12
	524	126	12	46	22
	446	134	5	31	[illegible]
	511	128	4	32	[illegible]
	499	146	13	24	11
	417	98	4	25	11
	418	93	11	18	[illegible]
	431	92	6	22	[illegible]
	464	131	6	34	11
	424	81	10	13	[illegible]
	420	95	7	18	[illegible]
	454	89	5	16	11
	518	122	10	29	[illegible]
	380	82	12	21	[illegible]
	432	87	3	18	[illegible]

e highest death rate shown was in 1892 when the rate was
per 1,000, and the lowest was in 1905 when the rate was
The average for the twenty years is 19.45. The averag
rate for the State for the past five years is 16.8, and for
ıkeepsie for the same time is 17.6, showing an improve-
over the twenty-year average, although not up to the State
ge. The values for the death rate by five-year periods are,
ıing with 1887, 20.4, 21.6, 18.0, 17.6, showing a steady
vement, although the present rate is not as low as could be
d. If the difference between the Poughkeepsie rate and
ırmal State rate is only one per 1,000 it means twenty-six
deaths in Poughkeepsie than occur on the average through
st of the State, and for this there must be a reason.

gram No. 2 shows the death rate per 100,000 from typhoid
the lowest rate in 1898 being 21.1 and the highest in 1893
he rate rose to 95.4. The average for the past twenty years
en 41.2.

iew of the fact that the average death rate for the State of
chusetts has been steadily decreasing until in 1894 it was
15.9 per 100,000 population, and for all the cities and
of the State with a population over 5,000 was only 19.0
5, a typhoid fever rate such as Poughkeepsie has is far too

large and implies unmistakably some insanitary condition which probably is to be found in connection with the water supply.

Again, the health of a community is measured by the number of deaths of children under five, since they are peculiarly susceptible to disturbances in the digestive tract, brought about by polluted water or by improper food. The ratio of deaths under five to total deaths under normal conditions is about 30 per cent., that is, 30 per cent. of all deaths per year are under five years old. In Poughkeepsie the average number of deaths per year for the past twenty years has been 457, and the number of deaths of children under five, 113.7, a ratio of 24.8. This indicates that the unhealthy conditions are not confined in their bad results to children, nor do they affect the children even in the same ratio as the adults on the average. In Diagram No. 3 is plotted the number of deaths under five for each of the twenty years, and it is plainly seen that the general tendency of the curve is downward, that is, that sanitary conditions are improving and they have not been, within the last twenty years, of such a character as to produce a high death rate among children. The deaths under five for the year 1906, however, mean a death rate of 3.3 per 1,000 of reporting population, whereas a normal death rate is only about half of this amount, showing that although for that year the general death rate was low, 16.9, the improvement in the deaths under five has not been great enough to keep pace with the general death rate improvement. The deaths under five are, however, not enough in numbers to be alarming.

The deaths from diarrhœal diseases are not large, being an average of the past twenty years of 32.2, 115 per 100,000. In Massachusetts the normal rate for the cities of the State for a number of years past has been about 100 per 100,000, indicating that in this regard no extraordinarily unhealthy condition prevails in Poughkeepsie.

The curves on Diagram No. 2 show plainly, however, that the same causes which operate to produce typhoid fever also affect the diarrhœal death rate since the curves of the two diseases are plainly similar. It is to be expected, therefore, that any means adopted to reduce typhoid fever will also reduce the diarrhœal death rate.

DIAGRAM No 3

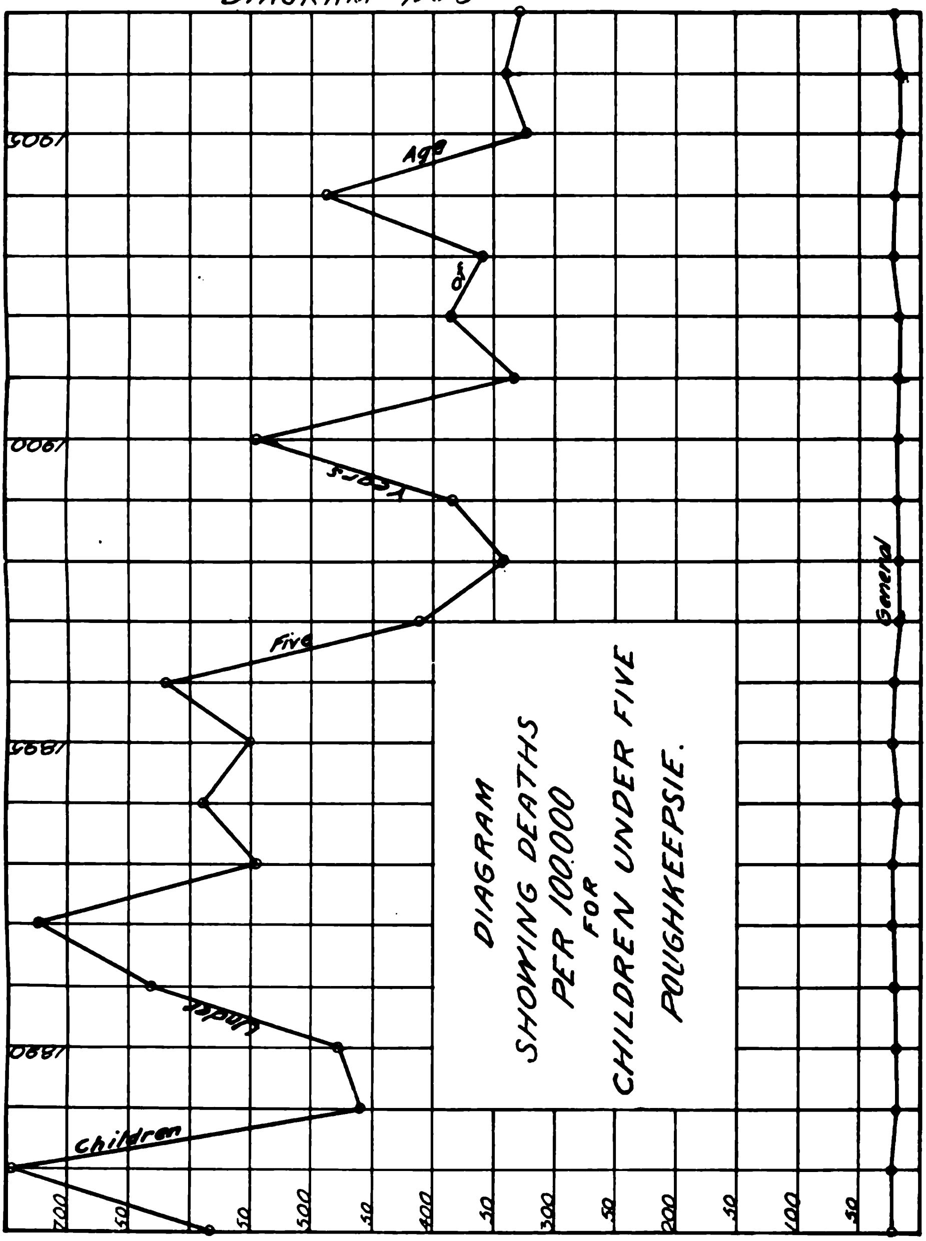


DIAGRAM
SHOWING DEATHS
PER 100.000
FOR
CHILDREN UNDER FIVE
POUGHKEEPSIE.
1880
1885
1890
1895
1900
1905
700
50
50
500
50
400
50
300
50
200
50
100
50
Children
Under
Five
Years
of
Age
General

Sewerage

The first annual report of the board of water commissioners was made in 1868, although as noted above, the city had had a water system from the Fallkill since 1835. But since 1868 the length of sewers and water mains supplied from the Hudson river have been continuously increasing under a permanent direction. The sewers are on the combined system, carrying house sewage and storm water and discharging into the Hudson river through submerged outlets. The sewers at present are in good order and their operation is continuous and satisfactory. There are, however, certain portions of the city which cannot drain into the present distribution system. Surveys are now being made whereby plans for draining these portions may be drawn. These portions are as follows: The southeast corner naturally draining into the southwest into Casper creek, and outside of and beyond the Main street sewer; the northeast corner naturally draining into Fallkill, but an area which cannot be accommodated in the already overtaxed Mill street sewer. Similarly the northwestern portion of the city is in urgent need of drainage without any outlet being available.

There are altogether twenty and one-half miles of sewers in the city ranging in size from 72–48 down to ten-inch pipe. The minimum size generally is 12-inch pipe, of which there is about ten miles and there are four miles of sewers twenty-four-inch or larger. Catchbasins, about 275 in all, are provided at the storm water inlets and these are regularly cleaned out by direction of the board of public works.

The water distribution system comprises thirty and one-quarter miles or nearly ten miles more than the sewers, showing that a considerable area is not sewered. Again, there were reported in 1905 2,811 house connections. If the average number of persons per connection be taken as six, or one connection be assumed for each house, 2,811 connections means 16,866 persons connected with the sewer out of a total population of 26,024, showing again that the sewer system is inadequate. Furthermore, there are reported in 1906 by the water board 3,712 services, or water connections, which means about 22,272 persons reached by the water system, or 5,400 more than have sewer connections. effect of this inadequate sewer system is that the people use pools, and the use of cesspools in communities where wells relied on for water supply is objectionable.

An examination made in 1903 showed 500 wells in us thickly populated parts of the city, many undoubtedly badly taminated. The inspector of this Department inspected pe ally a number of these wells and found the well to be in proximity to the privy vault, in many cases less than twenty It is, therefore, a matter of some importance, in considering conditions giving rise to a high typhoid fever death rate, to in mind the possible pollution of these wells. A complete s of the influence of the wells on the city's health would requ personal investigation of each case of illness, with a view o termining if possible, whether the well water, or city wate some other cause, was responsible. This is manifestly ou the range of this present investigation, but the possibility o fection from wells is to be noted.

Diagram No. 4 is a map of the city on which have been lo all the cases of typhoid fever which occurred from Decemb 1906, to June 1, 1907, ninety-six cases in all. It is of int to note that the location is general throughout the city. number of cases in the densely populated district where the jority of the wells are to be found are plainly not great number than the density of the population would account Therefore, the continuance of typhoid fever cannot be asc to the use of well water alone. It is further of interest to how in spite of the less thickly settled territory, the numb cases is large in the vicinity of the water reservoir and how number is less in the opposite side of the town, suggesting immediate effect of badly polluted water.

Ice

The largest ice company in Poughkeepsie is The High Ice Company, distributing about fifty tons daily. Their i partly cut from Prate's pond, a small lake on the west bar the Hudson in the township of Lloyd. The pond covers abou acres, its drainage area is heavily wooded, a ditch from the

leads into the pond, and the natural debris from a heavy timbered watershed is found in the water. There is a small population of about sixty on the watershed, but the supply is probably good.

The main supply, however, comes from Highland pond. A population of about 100 is on this watershed, and the inspector reports some contamination of the feeder streams entering the pond. The pond is shallow and has a growth of algæ on the surface in summer.

The next largest dealer is the Poughkeepsie Coal & Ice Company, who distribute about thirty-six tons daily. Part of their ice is cut from Upton lake, a natural pond fifteen miles northeast of the city in an agricultural country. The soil of the watershed is composed of clay and glacial gravels and the district has but little timber. The pond covers about forty acres and has a sandy shore except in the southeast where it forms about five acres of swamp. No contamination from sewage nor cattle could be observed. A summer boarding-house with accommodation for about thirty-five persons is situated on the western shore about 1,000 feet back from the lake and twenty-five feet above it. This establishment sewers into a large water-tight masonry cesspool. The watershed population is about seventy-five in summer and fifteen in winter, and the pond would seem, especially in view of an analysis submitted by C. P. Robertson, chemist, of Poughkeepsie, to be of satisfactory quality.

The company also cuts from Morgan pond, a pond in the northeastern corner of the city and covering an area of about twenty-five acres. This ice is said to be used for cooler purposes only — the water having the appearance of being stagnant, and the population on the watershed being more dense. There is one 7,000-ton icehouse on this pond and a 4,000-ton house on Upton lake, the ice from the latter being, it is claimed, used exclusively for family purposes.

The Hygeia Ice Company supplies an artificial product taking water from the city mains and filtering it three times through charcoal and sand. It is then distilled and frozen. The daily output is twenty tons. In the spring and fall water from the Fallkill is said to be used, which is contaminated by numbers of outhouses, privies and garbage dumps, but the water subsequently filtered and distilled.

The Voila Lake Ice Company distributed about four tons daily, the supply coming from an artificial pond east of the city. The pond covers about ten acres and is made by damming a small stream which flows through the State hospital grounds. In the summer the stream and pond are often dry, with heavy vegetation covering both. The ice is held in suspicion, although the annual crop is said to be about 3,000 tons, or about one-quarter of that stored by the Poughkeepsie Coal & Ice Company, who have capacity for about 11,000 tons, and who distribute about thirty-six tons daily.

The ice supply is chiefly natural ice, taken from small ponds in the immediate vicinity of Poughkeepsie. There is no apparent contamination, except in Morgan pond, which is only used for coolers. The artificial ice is said to be filtered and distilled. Under these conditions the ice supply is satisfactory and no insanitary condition of the people can properly be ascribed to ice.

Milk Supply

The milk of the city is obtained from farmers located within a radius of twelve miles of the city on the east side of the Hudson river. A list compiled from the license record kept by the health officer shows 1,321 cows distributed among ninety-seven farmers, all of which have been inspected by the health officer of the city and the dairy rated according to the score card there in use. The farmers are warned that a score of less than 60 per cent. is a just ground for the rejection of milk from that dairy and farmers visited by the inspector at random were found to score about 80 per cent.

It is not likely in view of the large number of dairies, with the small average of thirteen cows each, and with no systemized central distribution office that any continuous effect of polluted milk would be found. The well-directed efforts of the health officer also are strong arguments against the possibility of any widespread epidemic from milk. It must be agreed that this article of food is carefully and properly supervised.

In 1906, ninety children under five years of age died in Poughkeepsie, of whom sixty-one were under one year of age, the total deaths being 432. In per cent. the deaths under one were fourteen. and under five were twenty-one. The normal death rate for deaths under one is twenty-two and under five, thirty, so that the actual deaths in 1906 show again a lower death rate among children than would naturally be expected. It suggests that the proportion of children under five to total population is less than normal and such a disproportion would explain the low death rate from diarrhœal diseases already noticed.

Garbage Disposal

The garbage of the city is collected and disposed of under contract by Edward Senk, who hauled the loads to a farm of John Myers, about two miles northeast of the city proper, and just on the boundary line. Here it is deposited on the ground in thin layers and after twenty-four hours mixed in with the earth by means of a cultivator. A slight odor characteristic of garbage was detected by the inspector at the time of his visit to the farm, but the locality is thinly settled, the nearest house being a mile away and no nuisance seems to be created. For purposes of collection the city is divided into two districts from one of which garbage is collected on Monday, Wednesday and Friday, while from the other the collection is made on Tuesday, Thursday and Saturday. The wagons are covered oak tanks on wheels, are watertight, and are cleaned and washed thoroughly after each day's work. The inspector reports them as free from odor and offal of any kind. The methods and results of the garbage disposal seem to be satisfactory and the conditions favorable rather than prejudicial to the public health.

Pavements

The city has but little pavement, three and one-half miles of pavement as compared with twenty miles of sewers and thirty miles of water-mains. Main street is paved from the river up to Cherry street, a distance of 6,500 feet. Mill street is paved from the bridge at Delafield street, up to Hamilton street, a distance of 4,000 feet. Five cross streets between these two streets are paved, an additional distance of 3,375 feet. Besides the above, Market, Liberty and Catherine running north and south add 2,475 feet, and Cannon and Church streets, east and west, add 1,800 feet more, a total of three and one-half miles as above.

Of this, 1.54 miles is asphalt block pavement, which has been laid a number of years, is practically worn out and is even in dangerous condition in a number of places. The surface has become badly rutted, the ruts holding pools of black water and mud.

There is one mile of brick pavement in good condition on the lower end of Main street chiefly.

There is ninety-four hundredths of a mile of sheet asphalt in three small stretches, which is maintained by the city in good condition, the city owning a small repair plant. Besides this so-called improved pavement, a large amount of work is done on the dirt streets. For example, in 1906, 2,128 cubic yards of broken stone were used for top dressing some of the streets, 1,993 cubic yards of rubble stone and stone dust, and 1,383 cubic yards of gravel, and similarly in other years. The latter work, however, does not seem to be done systematically, to make a smooth macadam surface, but in many places is merely dumped and spread. The general impression of the streets is that they are dirty, in spite of the hand sweeping which the paved streets receive. Seven men sweep the three and one-half miles of streets or about one-half mile each daily. The sweepings are carted away and used for filling. The rest of the streets are scraped with a road machine spring and fall, and sometimes rolled with a steam roller. Apparently the pavement improvement has not kept pace with the growth in population and much remains to be done before this branch of city housekeeping can be said to be in good order. The effect on the health of the community cannot, however, so far as can be seen, be unwholesome, and is only a reflection on the character of the city.

Water

The water supply of Poughkeepsie is of peculiar interest in that the first sand filter plant in America was built in Poughkeepsie, and the experience there obtained is most interesting and valuable. The construction of the system of water works was commenced in 1869 and completed in 1872. The water is taken from the Hudson river, almost directly in front of the city, and pumped by low pressure pumps into a small settling basin, whence it flows onto the filter beds. The drains from the filter beds lead back to the pumping station whence a high pressure pump lifts the filtered water to a large distributing reservoir. The figures show this general arrangement. The superintendent for the past twenty-five years has been Mr. Charles E. Fowler, and the following description of the plant is taken from a paper by him read before the N. E. W. W. Association on March 9, 1898, and from his annual reports since that time. The quality of the Hudson river is acknowledged to be bad, and totally unfit for domestic use in its raw or unfiltered state. Its drainage area above Poughkeepsie is about 11,500 square miles, and a total population on the watershed of about 1,000,000 people. Fifteen miles above Poughkeepsie on the opposite shore is the city of Kingston, containing 25,000 people, the sewage from which city is, except for the first ward, emptied into the Hudson. Forty miles above on the same shore, is the city of Hudson, with 15,000 persons discharging sewage into the river. Seventy miles above is the city of Albany, with a population of 100,000, and all the pollution which comes down the Mohawk from Cohoes, Schenectady, etc. A short distance above Poughkeepsie on the same side of the river is located one of the New York State hospitals for the insane, with a resident population of about 1,500. The outfall sewer of this institution empties into the Hudson river 2,797 feet above the intake of the water works, and in a tidal current which on the ebb flows directly past the intake. Further, the sewage of Poughkeepsie itself is brought upstream by the flood tide far above the intake, but the main current is nearer the center of the river. The width of the river at the intake is about 2,400 feet with a nearly uniform depth of fifty feet.

The entire dependence of the city, therefore, so far as the quality of the water is concerned, is placed on the filter plant, and upon its ability to take out of the water its polluting ingredients. The original or old plant was located 500 feet east of and twenty-eight feet above mean high water. It consists of a settling basin twenty-five by sixty by twelve feet deep. The filter bed adjoining is 200 feet long, 150 feet wide, divided into two sections by a wall through the center. The walls are vertical, of rubble masonry, and twelve feet in height from coping to concrete bottom. The filtering material occupies one-half the depth, comprising, beginning at the bottom, twenty-four inches of coarse broken stone, six inches of one-half inch gravel, six inches one-quarter inch gravel, and twenty-four inches of sand. A main drain, of dry rubble two feet square, in section extends longitudinally through the center of each section, and two lateral drains of same dimensions traverse each section at right angles to the main drain. These drains lead through an intermediate channel into the filtered water basin and thence to the pumps. During the first years of its existence the filter was not in continuous use, and the uninterrupted filtration of water did not begin until 1876. For ten years or till 1886, the filter was operated, with the periods between cleaning gradually reduced, until in the latter year, the entire twenty-four inches of sand was removed, washed and replaced. Before this time thin layers had been removed and replaced in the operation of cleaning, but no entire removal had been practiced. By 1890 the sand thickness had gradually been reduced to six inches, and even that thickness was so dense and clogged that the full consumption was imperilled. It was, therefore, all removed, washed and replaced.

In 1893, about 400 cubic yards of new sand were added and the next year 300 yards more. In 1897 the old sand was thrown away and thirty-nine inches of new sand put on. In this same year a second filter was put into operation. Its area is equal to that of the old bed, i. e., two-thirds of an acre, the general construction being the same as in the old bed. The filtering material is ten inches of broken stone, eight inches of one-half-inch gravel, six inches of one-quarter-inch gravel, then thirty-one inches of sand. The two beds with the reduced rate of delivery are run much more easily, being cleaned about once a month, depending on the turbidity of the river. In 1895, on April 11th, the old bed was cleaned, again on the 29th, again on May 6th, and again on May 16th, each time the cleaning being required by the fact that the beds were so clogged that the necessary amount would not run through, and on the average of once in two weeks through the year.

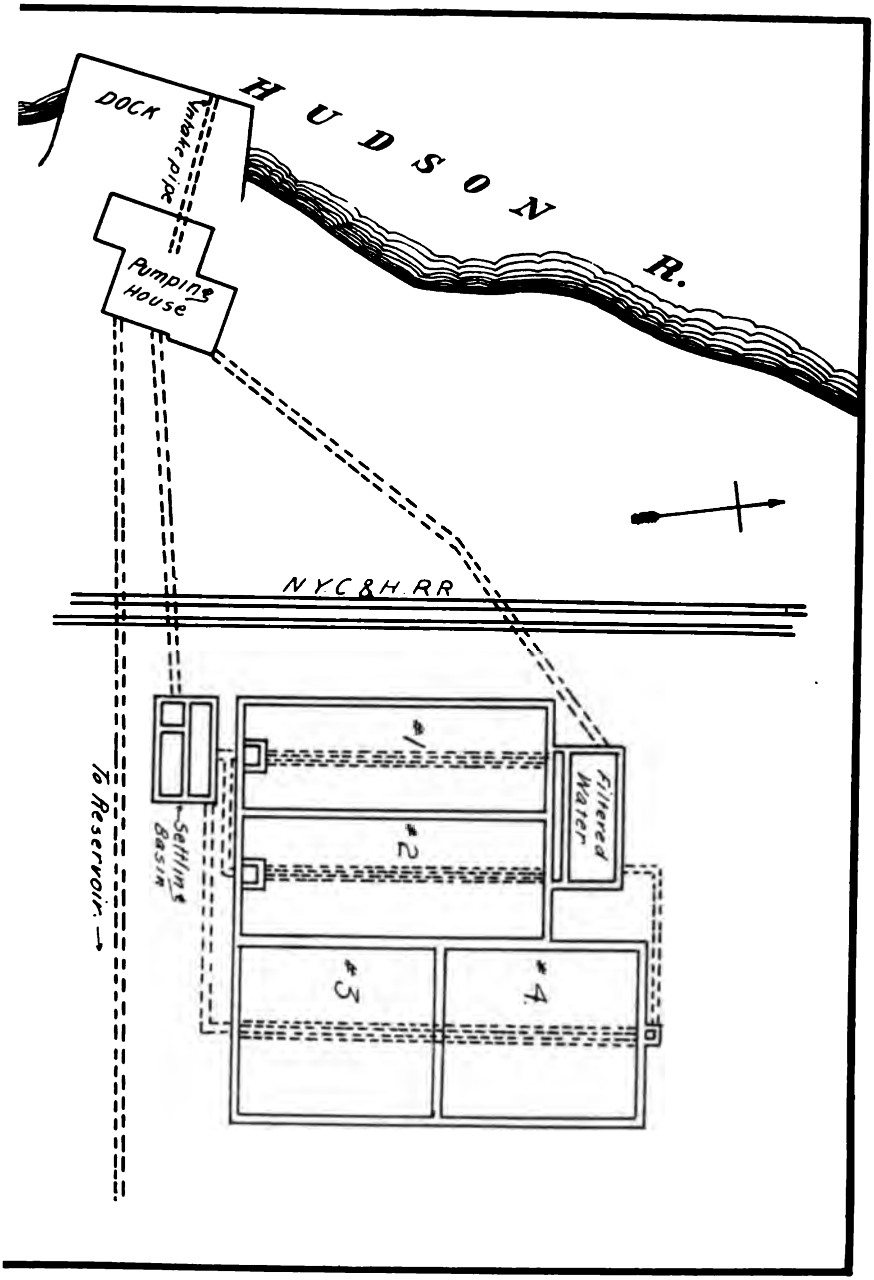

DOCK
Intake pipe
HUDSON R.
Pumping House
N.Y.C.&H.R.R
Settling Basin
To Reservoir.
#1
#2
#3
#4
Filtered Water

DIAGRAM V.

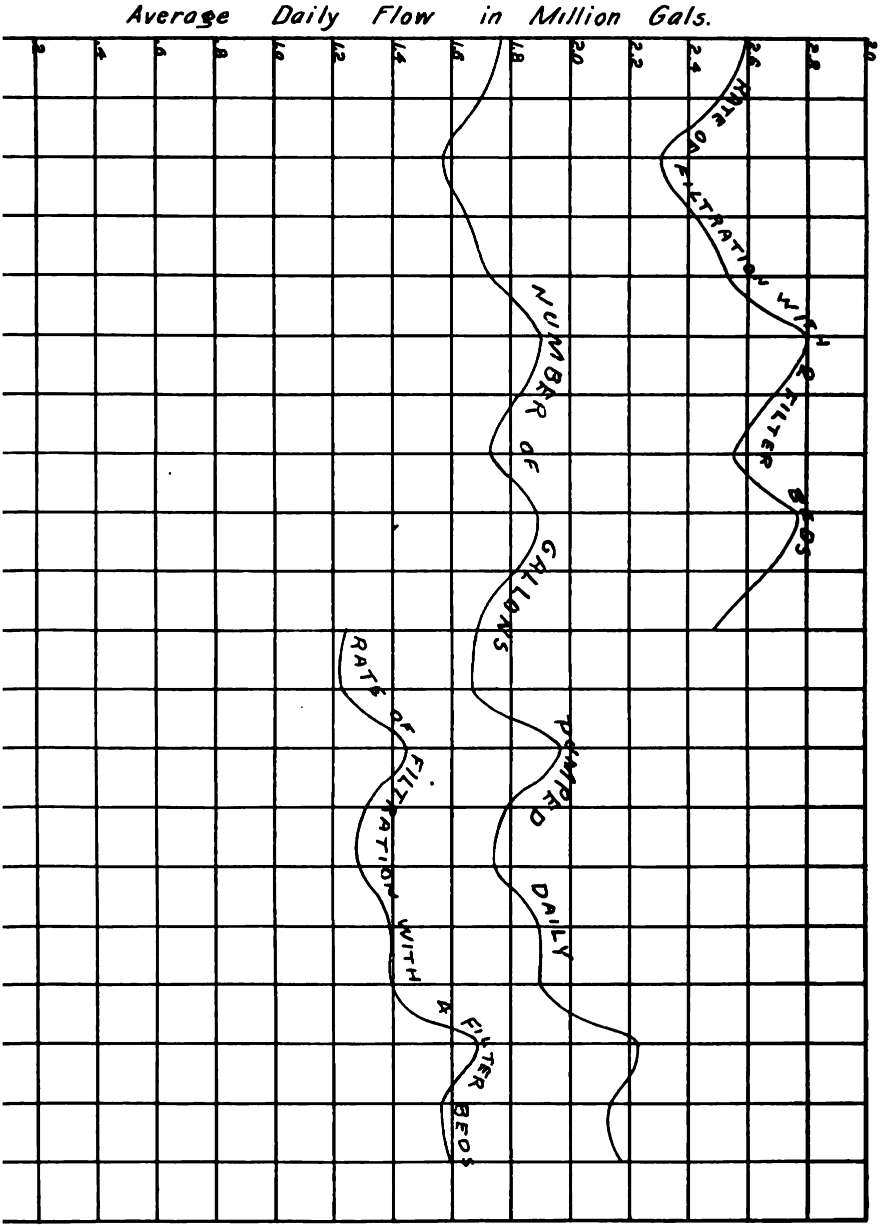

Average Daily Flow in Million Gals.
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
RATE OF FILTRATION WITH 8 FILTER BEDS
NUMBER OF GALLONS PUMPED DAILY
RATE OF FILTRATION WITH 4 FILTER BEDS

Diagram No. 5 shows the average number of gallons pumped daily, together with the number of gallons per acre per day passed through the filter.

Until the past few years, but little has been known of the efficiency of the filter. It has been able in years when Albany has suffered from severe typhoid epidemics to hold the rate down to an average of 41.2. Mr. Fowler, who has watched the behavior of the bed very carefully, says that he is not able to trace any definite relation between the condition of the beds and the typhoid fever death rate, except that he notes the greatest number of deaths in the winter when the efficiency of the beds is lowest. In 1893, for example, when the high death rate of ninety-six per 100,000 is shown, the winter was unusually severe, and in February the beds were cleaned only by first removing an eighteen-inch layer of ice. This undoubtedly reduced the efficiency of the beds for several weeks. Similarly the superintendent reports that the winter of 1904 was the severest experienced in many years. For over a month an average of sixty-six men were continuously busy removing ice and snow and cleaning the filters. In 1900 and 1901 no climatic conditions seem to have been operative.

In 1904 the city authorized the expenditure of $60,000 for roofing the filters, for putting in new water-tight floors, and for relining the side walls in both filters, and for putting in a central transverse wall in the new filter, making four units in all, each of about one-third of an acre, and since December 1, 1904, the water has all been filtered through these four units, as reconstructed, although the old bed, which was improved after the other, was not working until well into the year 1905. The cost of cleaning during the winter of 1904–5 was at the rate of $789 per year, while the preceding winter with the climatic conditions no worse, the cost with the uncovered filters was $4,217, a strong evidence in the economy of covers, since the saving of $3,428 represents the interest on $85,700, about three times the actual cost of the arch covers.

The bacterial efficiency of the new filter during the past of the year 1904, before the improved filter was put into service, averaged 831, the samples being taken every two weeks. In 1905, the bacterial efficiency from samples taken about twice a week averaged, was 84.5 from Filter No. 3, and 79.86 from Filter No. 4, the two halves of the new bed.

In 1906, Filters Nos. 1, 3 and 4 gave average efficiencies of 91.1, 93.0 and 91.6.

In 1907, for a period of nine weeks in the summer when analyses were made daily, the efficiencies were as follows: No. 1, 94.3; No. 2, 96.6; No. 3, 94.1; No. 4, 92.2. These efficiencies are not as good as have been obtained elsewhere. For example, the Lawrence city filter, uncovered, had a bacterial efficiency in 1906 which averaged 99.5.

The present failure of the Poughkeepsie filters to show creditable results is a matter of grave concern to the water board and to the superintendent of the water works. It had been hoped that after the repairs and additions made to the filters in 1904–5 that immediately beneficial results would be apparent. But the bacterial efficiencies are as yet markedly inferior and the number of cases of typhoid fever in the winter and spring of 1907 were in the nature of a veritable epidemic. In their anxiety to ascertain the cause for this unexpected and disappointing outbreak, the water board asked Mr. George C. Whipple, whose ability and experience in matters of water purification are widely known and recognized, to study the conditions, to advise them as to the causes and to suggest suitable remedies. On April 16, 1907, Mr. Whipple reported that the cause of continual typhoid fever in the city is undoubtedly due to the water supply, which is imperfectly filtered. He recommended various methods of improving the efficiency as follows:

1. That an additional foot of sand be added to all the filters so as to make the filter bed four feet deep.

2. That a sedimentation basin having a capacity of two or three million gallons be constructed in which a coagulant could be added at times of greatest pollution.

3. That the filters be run continuously, and not shut down on Sunday as heretofore.

4. That in cleaning, all the dirty sand be removed from the filter whenever it is scraped, even though it be necessary to take off an inch or more in thickness.

These recommendations have all been carried into effect, the sedimentation basin being practically completed by January 1, 1908.

The State Department of Health has also been much concerned at the continuance of typhoid fever in Poughkeepsie during the early part of the year 1907.

On March 9th, Mr. L. M. Wachter, Sanitary Chemist of the Department, having visited the filters and made analyses of the raw water and of the effluent, reported that the analyses showed results which were far more satisfactory, particularly in the case of Filter No. 2.

On March 12th, Dr. H. D. Pease reported that in view of the continued correspondence between the number of cases of typhoid and the number of bacteria in the filtered water, the prevalence of the disease is undoubtedly due to imperfectly filtered water. He also expressed his belief that the Hudson river water at Poughkeepsie does not contain enough of the organic matter which is of value in producing the filtering surface on top of the sand, and that for this reason the results of filtration are inferior to the results obtained at Albany. He recommends that greater care be exercised in running the filters, adjusting the rate of filtration to the efficiency obtained.

On April 11th, Mr. Theodore Horton, Chief Engineer, visited the filters and carefully considered the conditions. He also concluded that the result of the excessive typhoid fever rate in Poughkeepsie was due to the water supply. He recommended that coagulation should be employed in the sedimentation basin and that steps should be taken to improve the quality of the raw water. This could be done, he pointed out, by carrying the intake pipe a few miles north up the river, getting away from the present dangerous proximity to the Poughkeepsie sewer. He also recommended that an intercepting sewer be constructed which should take the city sewage away from its present points of discharge to a point at the extreme southerly end of the city.

As already pointed out, there have been carried out the changes in details of filter construction and operation above referred to, although the results of the sedimentation tank treatment are not yet available. The suggested modification of the sewer system and the changed location of the intake have not yet been taken up.

Summary

1. The history and location, as well as the social and industrial characteristics of Poughkeepsie, do not offer any indication of insanitary conditions in the city.

2. The general death rate in Poughkeepsie for the past twenty years has been 19.45, above the average for the State, and for that reason alarming and deserving attention.

3. The death rate of children under five years has been less than the normal, and the death rate from diarrhœal diseases has been below the normal, showing that the high death rate has not arisen from the deaths of children.

4. The average death rate from typhoid fever for the years 1888–1906 was 41.2, varying from 21.1 to 95.4, the average being nearly three times a reasonable and moderate rate.

5. The responsibility for these high death rates does not appear to lie in the design or maintenance of the sewer systems, but the fact that certain portions of the city are without sewers, and that well waters are used for domestic supply in those portions, makes the lack of sewers in certain sections of the city alarming and should be remedied at once.

6. The collection and disposal of garbage is, insofar as can be seen, satisfactory and sanitary and should have no effect upon the good health of the city.

7. The area of improved or paved street surface in the city is relatively small and the general impression of the city is one of dirt, disrepair and mud. But broken stone and gravel are making a continual improvement. The wornout pavements are to be replaced and material improvement may soon be looked for. It is not likely that the present conditions are in any way a menace to the health of the city.

8. The ice taken from Viola lake probably contains considerable organic matter, and ice from Morgan pond is undoubtedly contaminated. The latter, however, is used only in coolers and the amount used of the former is so insignificant, that even if it were very bad the effect on the city death rate would be inconsiderable.

9. The milk supply, in view of the low death rate among children under one year, and the care and efforts of the health officer

in the matter, and also by the large number of dairies concerned, is satisfactory and its quality well guarded.

10. There are a large number of wells in use in Poughkeepsie, wells which take their supply from a ground water probably polluted directly by privies and cesspools as well as by the accumulations which years of habitation have left in the soil, but there is no evidence that these wells are entirely responsible for the excessive typhoid fever.

11. The water supply is originally raw or polluted Hudson river water — polluted immediate by the sewage of Kingston, the State hospital, and by the city of Poughkeepsie. For thirty years the city has filtered the water through a slow sand filter, keeping the death rate from typhoid fever down to an average of 41.2, where without the filters the rate would undoubtedly have been two or three times this amount. Since 1904, the filters have not only been ample in size but have been protected from winter temperatures, so that better results should be obtained than before that year. Insofar as the early construction of the filter and the uninterrupted service for thirty years is concerned, the city, the water board and the water works superintendent deserve hearty commendation.

12. The conditions, however, are not yet good. The typhoid death rate for 1905–1906 was 34.0 and 32.4 and the rate for 1907 will probably be about 90. The high general death rate should be reduced. Important changes have been made during this past year, 1907, particularly by the construction of a large sedimentation basin by which it is hoped the quality of the filtered water will be much improved. The highest anxiety of the local board of health, supported by the approval of the general enlightened public spirit, should be to restrict every case of intestinal diarrhœa as well as properly diagnosed typhoid fever to its immediate locality, and by thorough disinfection and quarantine finally stamp out the disease which has for so long had so strong a hold upon the people of Poughkeepsie.

Respectfully submitted,

H. N. OGDEN,

Special Assistant Engineer

INVESTIGATION OF PROPOSED WATER SUPPLY FOR NIAGARA FALLS

ALBANY, N. Y., *December* 26, 1907.

EUGENE H. PORTER, M. D., *State Commissioner of Health,*
Albany, N. Y.:

DEAR SIR:— In accordance with your request, I beg to submit the following report upon an investigation of the propriety of using water from Niagara river at the lower end of Grand island for a source of improved water supply for the city of Niagara Falls.

This report may properly be considered an outgrowth of our special investigation and report upon the sanitary conditions of the city, as a result of which it was pointed out that the high typhoid fever death rate was due to the continued use of the present polluted water supply. Following the submission of this report to the city authorities, the question of securing a new and purer supply was at once considered by them, and you were subsequently requested to make an examination into the question of the possibility of securing a satisfactory supply from the Canadian channel. This question has already been partially investigated by other experts, and the letters, reports and general information available were referred to you for use in this investigation.

It appears that the city contemplates taking a new supply from Niagara river through a submerged pipe line or conduit, having the intake located at a point most favorably situated opposite the lower end of Grand island. The vital questions which arise with respect to this proposition are: *First*, whether a purer supply can be secured from the Canadian channel than from the American channel; *secondly*, at what point in either channel is it possible to obtain the purest water; and, *thirdly*, whether the water taken from this latter point is of sufficient purity to serve as a potable and reasonably safe supply for the city to use.

It appears that chemical and bacteriological examinations have been made of the water of Niagara river and Lake Erie at different points above Niagara Falls by various chemical and bacteriological experts, and I have been furnished with, and have carefully reviewed, the reports of Prof. Ernest J. Lederle and of Dr. Rudolph Hering, based upon these examinations and other evidence. I have also carefully read the report of Prof. H. N. Ogden, Assistant Engineer of State Department of Health, reviewing the evidence and opinions in the aforesaid report.

It will be unnecessary to review again the reports thus presented to you, beyond pointing out the insufficiency, or inadequacy, of the examinations and other data so far presented, to furnish conclusive evidence as to the purity of the proposed supply. In fact, so little light has been so far thrown upon this question by the examinations already made, and so cautious, if not contradictory, have been the opinions expressed, that you have directed me to arrange with the laboratory division to have such additional examinations made of the water of the Niagara river, as will give more indicative, if not conclusive, evidence as to the purity and potability of the river water at the proposed site of intake.

In general, we may say that the question before us may be solved by the determination of the following two points:

1. Whether the lake water above Buffalo is, in itself of sufficient purity to be considered potable and safe for a public water supply.

2. Whether the lake water, in its passage through the Niagara river, is at any time subject to such accidental or general pollution from the sewage of Buffalo, or other municipalities on the river, above Niagara Falls, as to render the quality of the water taken from the proposed intake unfit for public water supply purposes, without purification.

The first of these questions appears to be more determinable than the second one, and, in the light of the evidence already furnished, there seems to be little doubt that, outside of the question of turbidity, arising from wind disturbances, the quality of the water of the lake, at points distant from shore pollution, especially near the Canadian side, would fulfill all reasonable requirements for a potable supply.

The second question is, however, not so easily determinable. That is, the effect of the discharge of sewage from the city of Buffalo, and other municipalities, situated along Niagara river; the extent of mingling, or diffusion, of this sewage with the river water in its passage through the tortuous channels; and whether the sewage of Buffalo (assuming for the time being that the sewage discharged from the Canadian shore is relatively insignificant) ever reaches the Canadian channel on the west side of Grand island, are all questions much more difficult and important to answer. In fact, in reviewing the evidence presented in the reports above referred to, it is evident at once that, although these analyses were valuable in a general way, the selection of the sample stations in these investigations were not made, either as to number or location, to throw much light upon this particular point. It was, then, with the purpose of determining this more important point that the arrangement of sample stations hereinafter described was decided upon.

One of the first points that seemed to be clearly shown from a study of the results of the chemical and bacteriological analyses referred to was that the question of relative pollution in the river could not be readily determined by chemical analyses alone, and that, aside from determining the general quality of the water, chemically, these analyses would be of little value. This is due to the fact that the volume of water in the river is so large, and the dilution so great, that chemical analyses are unable to indicate the changes; and because the time which elapses in the travel of the water from the lake to the proposed intake is too short to afford opportunity for natural chemical and bacteriological changes to take place. Principally upon this account, but partially because a series of elaborate chemical determinations could not be carried out in an interval of time short enough to preclude a change of conditions in the river — it being essential to have each of a series of determinations made under the same conditions, as to volume of flow, direction of wind, etc.— it was concluded to confine the investigation entirely to studies of a bacteriological nature.

In view, then, of the more accurate comparative evidence of bacteriological tests in this case, and the saving in time required for such determination, I arranged, at your direction, with the laboratory division for the collection and examination of two series of bacteriological samples, taken on two different dates — November 3d and December 4th — from the lake and the river at the points described below, and shown also upon the accompanying sketch plan. The series of November 3d were taken at the following points:

1. A series of five samples taken across the lower end of Lake Erie, above Buffalo, about opposite the new intake of the Buffalo water supply.
2. A series of five samples across Niagara river just above International bridge.
3. A series across the American and the Canadian channels at the head of Grand island.
4. A series across the American channel opposite the intake of the proposed new water supply for Lockport (this series being only incidental to the question of the Niagara Falls water supply, and primarily in relation to the proposed Lockport supply); and
5. A series across the American and Canadian channels at the lower end of Grand island, and on the line of the proposed water intake for the Niagara Falls water supply.

The series taken on December 4th were collected on approximately the same lines across the river as in the November 3d series, with the exception of the first series, which was, as shown upon the plan, taken across the lower end of Lake Erie, near the northerly end of the breakwater, instead of opposite the new intake of the Buffalo supply.

In addition to the above bacteriological determinations, one set of chemical analyses was made of the river water from a point at the upper end of Strawberry island. This was for the purpose of showing the general chemical quality of the river water at this point.

It was originally contemplated to have these bacteriological determinations carried out for total numbers of bacteria and for the presence of B. Coli Communis; and further to have the series repeated one or more times, under different selected conditions of river flow, and direction of wind. It was believed that the results of such a series of determinations would indicate the general and relative intensity of horizontal stratification of sewage pollution of the water in the lake, and in its travel down Niagara river to Niagara Falls under favorable and unfavorable conditions of wind; that is, it would show the extent of the influence of surface currents, or undertow, at the lower end of the lake, during a southwest wind, when the water level at this end of the lake may be many feet higher than the mean level, in carrying any sewage from the Buffalo shore out to, or into, the Emerald channel; and would further show independently the relative hygienic quality of the water in the vicinity of the proposed intake at the lower end of Grand island. Unfortunately, however, it was not practicable to wait for the most desired and pronounced conditions of wind in this respect, although, fortunately, it *was* possible to arrange the collections on dates when the general direction of wind approximated the desired directions.

The first series of samples were, as stated, taken on November 3. On the day previous, November 2, a strong wind (possibly thirty to forty miles per hour) had been blowing from the southwest; while on November 3, the wind was from the northwest. It is thus evident that the series of samples on November 3 was taken at a time when the surface pollution from Buffalo sewage, below Buffalo, would *not* be carried toward the Canadian channel; and with the southwest wind on November 2, at a time when the effect of any undertow in the lake *would* convey sewage pollution from Buffalo, at the lower end of the lake out into the channel. The samples taken under these conditions would indicate the relative pollution, if any occurred, of the water in the Canadian channel under *favorable* surface, but *unfavorable* subsurface, conditions. Owing to the difficulty of collecting the samples on November 3 with a high wind and rough water surface, the samples were not collected at all of the points, nor in the exact positions, originally contemplated. Notwithstanding this, however, a sufficient number were collected, as described above, approximately near the desired points in the river, to afford a valuable indication of the extent and distribution of sewage pollution of the lake, and river water, under the conditions of wind that occurred on the day of collection of samples.

The second series of samples were taken on December 4. The wind on this day was from the east. The wind was light and from the northeast in the morning, shifting around to easterly in the afternoon, and increasing in velocity from about five miles, to from fifteen to twenty miles per hour. The conditions were thus favorable for carrying the sewage below Buffalo by surface currents from the American shore toward the Canadian shore, and consequently the series on December 4 represent the pollution of the river under unfavorable surface conditions.

The results of these determinations for November 3 and December 4 are given herewith in tabular form. In each case a detailed description is given of the location in the river where the samples were collected.

LOCATION OF SAMPLES TAKEN FROM NIAGARA RIVER

NOVEMBER 3, 1907

Upper End of River

Samples 1, 2, 3, 4, 5, across section near new intake point of Buffalo water supply, head of Emerald channel, about opposite Buffalo Yacht Club.

1. About 400 feet from Buffalo shore.

2, 3, 4, 5 in serial order toward Canadian shore.

Squaw Island near International Bridge

6. Two hundred feet from outside shore of Squaw island, about 500 feet upstream from International bridge.

7. Main channel upstream from International bridge.

8. Center of river upstream from International bridge.

9. About 300 feet from Canadian shore near International bridge.

10. No sample taken.

Between Frog Island and American Shore

11. Two hundred feet from American main shore, opposite Frog island.

12. Center of stream between Frog island and American main shore.

13. Two hundred feet from Frog island, opposite American main shore.

Between Frog and Grand Islands

14. Between Frog and Grand islands.

Cross-Section of the American Channel near Lockport's Proposed Intake

15. Two hundred feet from Grand island, and between Grand island and American shore, at North Tonawanda, where Lockport water is to be taken.

16. Center of American channel between Grand island and American main shore at North Tonawanda.

17. Two hundred feet from American main shore between Grand island and American mainland, American channel at North Tonawanda.

Samples Taken near Buckhorn Island

18. Seven hundred feet from American side of Buckhorn island and about one-half mile from down stream end of Buckhorn island.

19. Center of channel between Buckhorn island and Navy island, lower end of Buckhorn island.

Canadian Channel Opposite North Tonawanda

20. Canada channel between Grand island and Canada shore. In center of channel about in line with North Tonawanda.

Beaver Island, Canadian Channel

21. Six hundred feet from Beaver island shore between Beaver island and Canadian shore.

22. Five hundred feet from Canada shore between Beaver island and Canada shore.

ANALYTICAL RESULTS OF THE SAMPLES TAKEN IN THE NIAGARA RIVER, NOVEMBER 3, 1907, AT POINTS INDICATED

NO. OF SAMPLE.	TESTS FOR B. COLI TYPE.						Bacteria per cc.	Chlorine pts. per M.
	10 cc. Samples.		1 cc. Samples.		1-10 cc. Samples.			
1	2+	0—	2+	2—	0+	4—	1,300	7.5
2	0+	2—	1+	3—	0+	4—	960	7.0
3	2+	2—	0+	4—	0+	4—	970	7.5
4	0+	6—	0+	4—	—	—	250	7.0
5	0+	6—	0+	4—	—	—	150	7.5
6	0+	6—	0+	4—	+	—	62,000	7.5
7	4+	2—	4+	0—	+	—	11,000	7.0
8	3+	3—	0+	4—	—	—	430	7.5
9	6+	0—	1+	3—	—	—	1,100	7.5
10	....	....	....	....	....	....	....	....
11	6+	0—	4+	0—	0+	4—	140,000	7.5
12	6+	0—	4+	0—	0+	4—	19,500	7.5
13	2+	4—	1+	3—	0+	4—	6,400	7.5
14	1+	5—	0+	4—	0+	4—	360	7.5
15	4+	0—	4+	0—	—	—	4,800	7.0
16	5+	1—	3+	1—	—	—	590	7.5
17	4+	0—	0+	4—	—	—	91,000	7.5
18	4+	0—	3+	0—	—	—	4,100	7.5
19	0+	4—	0+	4—	—	—	220	7.5
20	4+	0—	1+	3—	—	—	230	7.5
21	3+	1—	0+	4—	—	—	390	7.5
22	1+	3—	1+	3—	—	—	210	7.5

DESCRIPTION OF THE LOCATION OF POINTS FROM WHICH WATER SAMPLES WERE TAKEN FROM NIAGARA RIVER, DECEMBER 4, 1907

A. *Cross-Section About One-Half Mile from the Foot of Buckhorn Island*

1. Five hundred feet from American shore.
2. Nine hundred feet from American shore.
3. Five-eighths width of channel from American shore.
4. Two hundred and fifty feet from Buckhorn island.

B. *Cross-Section at End of Buckhorn Island Running Toward Navy Island*

5. Five hundred feet from Buckhorn.
6. Center of channel.

C. *Cross-Section at Head of Navy Island Toward Grand Island*

7. Three hundred feet from Grand island.

D. Cross-Section at Head of Grand Island to Canadian Shore

8. Six hundred feet from head of Grand island.
9. Five-eighths width of channel from Grand Island.
10. Three hundred and one feet from Canadian shore.

E. Cross-Section Below International Bridge Between Squaw Island and American Shore.

11. Center of channel at foot of lock connecting Erie canal and Niagara river.

F. Cross-Section Running Through Lighthouses

12. At one-third distance from Buffalo lighthouse to south end of short breakwater.
13. At two-third point of same distance.
14. Three hundred and fifty feet from Buffalo breakwater lighthouse toward Horseshoe reef lighthouse.
15. Half way between above these lighthouses.
16. Six hundred feet east from Horseshoe reef lighthouse.
17. Six hundred feet west of Horseshoe reef lighthouse.

G. Cross-Section 700 Feet South of International Bridge Between Squaw Island and Canadian Shore

18. Two hundred feet from Squaw island.
19. Five hundred feet from Squaw island.
20. Five-eighths width of channel from Squaw island.
21. Three hundred feet from Canadian shore.

H. Cross-Section at Head of Frog Island Running from American Shore to Grand Island

22. Two hundred feet from Frog island.
23. Center of channel.
24. Three hundred feet from American shore.
25. Center of channel between Frog island and Grand island.

I. Cross-Section at Head of White's Island

26. At quarter point from Grand island.
27. At center point.
28. At quarter point from American shore.

ANALYTICAL RESULTS OF THE SAMPLES TAKEN IN THE NIAGARA RIVER, DECEMBER 4, 1907, AT POINTS INDICATED

NO. OF SAMPLE.	TESTS FOR B. COLI TYPE.						Bacteria per cc.	Chlorine pts. per M.
	10 cc. Samples.		1 cc. Samples.		1-10 cc. Samples.			
1	3+	0—	1+	2—	...		52,000	8.5
2	3+	0—	0+	3—	...		12,500	8.0
3	3+	0—	0+	3—	...		570	8.0
4	3+	0—	0+	3—	...		14,000	7.5
5	1+	2—	0+	3—	...		300	...
6	0+	3—	0+	3—	...		280	...
7	1+	2—	0+	3—	...		360	7.0
8	0+	3—	0+	3—	...		130	...
9	0+	3—	0+	3—	...		60	7.5
10	0+	3—	0+	3—	...		140	...
11	3+	0—	3+	0—	...		220,000	11.0
12	0+	3—	0+	3—	...		850	7.5
13	1+	2—	0+	3—	...		600	...
14	0+	3—	0+	3—	...		90	7.0
15	0+	3—	0+	3—	0+	3—	120	7.2
16	0+	3—	0+	3—	0+	3—	110	6.7
17*	...		...		...		...	7.0
18	3+	0—	3+	0—	0+	3—	140,000	8.0
19	1+	2—	0+	3—	0+	3—	270	...
20	1+	2—	0+	3—	0+	3—	160	7.5
21	0+	3—	0+	3—	0+	3—	130	7.5
22	0+	3—	0+	3—	...		180	7.5
23	2+	1—	2+	1—	...		600	7.5
24	3+	0—	3+	0—	...		24,000	7.5
25	3+	0—	3+	0—	...		140	7.5
26	0—	2—	0—	3—	...		300	7.5
27	1—	3—	0—	3—	...		375	7.5
28	2—	0—	0—	3—	...		14,500	...

* Sample bottle broken.

In these tables the samples are numbered in consecutive series, the positions of the sampling stations being shown approximately upon the accompanying plan. The tables are, in general, self-explanatory. In the columns showing Coli determinations, the sign " + " denotes the " presence of B. Coli " and the sign " — " " the absence of B. Coli." The numbers opposite each sign represent the number of samples in which B. Coli were or were not found. The sum of the numbers opposite the " + " and the " — " signs represents the total number of determinations made from each sample.

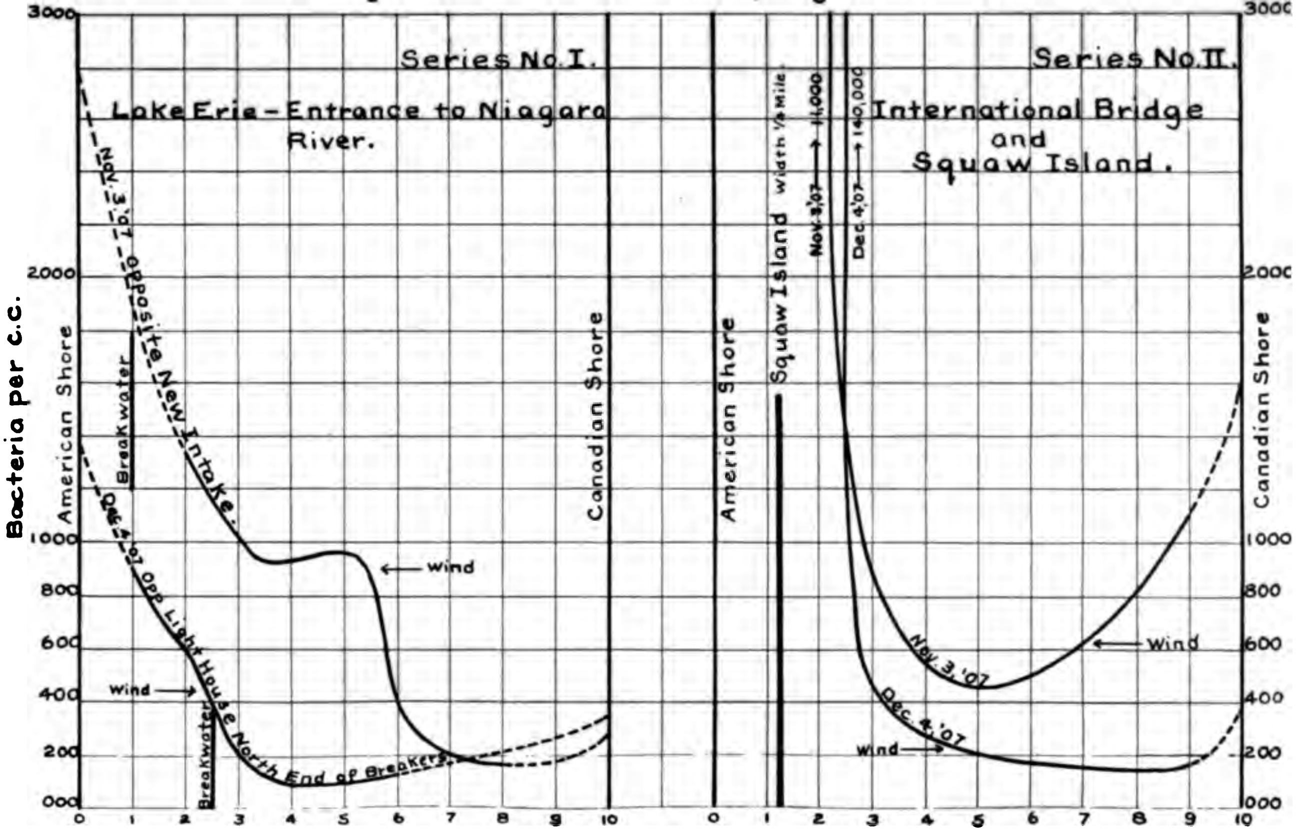
In order to show more graphically the relative numbers of bacteria in the cross-section of the river at the various points, the results in the above tables have been plotted, as profiles, for each day, November 3d and December 4th, for each of the five series of determinations. In each of these profiles, which accompany this report, the total width of the river is represented to a scale of ten and the numbers of bacteria present, at proportional distances from the east shore, are expressed as ordinates. This scale was adopted since the width of the river was quite variable, and since, for purposes of comparison of the different series, it was considered more important to know the relative numbers of bacteria at *proportional* distances between the two shores than at the *absolute* measured distances between these shores. Where sections included islands or breakwaters, the relative location of each is shown, but the width of the island or breakwater is reduced to a line; that is, the waterway having width of ten feet is composed of the sum of the two or three waterways between the American and the Canadian shores.

A study of these results thus presented indicates many important and interesting facts. Taking the results as a whole, they indicate by the numerical proportion of total bacteria, and of B. Coli, at the various points in the cross-sections of the river, that there is a considerable horizontal stratification of the river water in its travel below Buffalo; and that this stratification is maintained as far down as, and below, the head of Grand Island. In general the bacteria found in the river at each cross-section were generally higher on November 3d than on December 4th. This, in my opinion, was due to the high wind on November 2d, which stirred up the lake bottom and gave rise to not only relatively higher bacteria, as found, but to increased turbidity as observed on November 3d. As might be expected under these conditions, the Coli determinations were also higher in the November 3d series, but their general occurrence and relative distribution at all cross-sections — and especially in series No. I — on that day, indicates clearly that these B. Coli were not derived so much, if at all, from the Buffalo sewage as from the lake water itself, and resulted from a slight pollution derived from the sediment stirred up from the bottom. Incidentally it strongly indicates that, under such conditions of wind action, the water of Lake Erie is subject to pollution of this nature, and that this pollution from the bed of the lake, as might be expected, contains slight traces of sewage, deposited no doubt from sluggish currents that have bathed the populated shores, and from local causes such as steamboats. Owing, however, to the infrequency of effective disturbances of this kind, the small amounts of this pollution, and the effect of the time interval upon the viability of any disease germs, arising from the sources above mentioned. I do not consider this pollution of practical significance at this time.

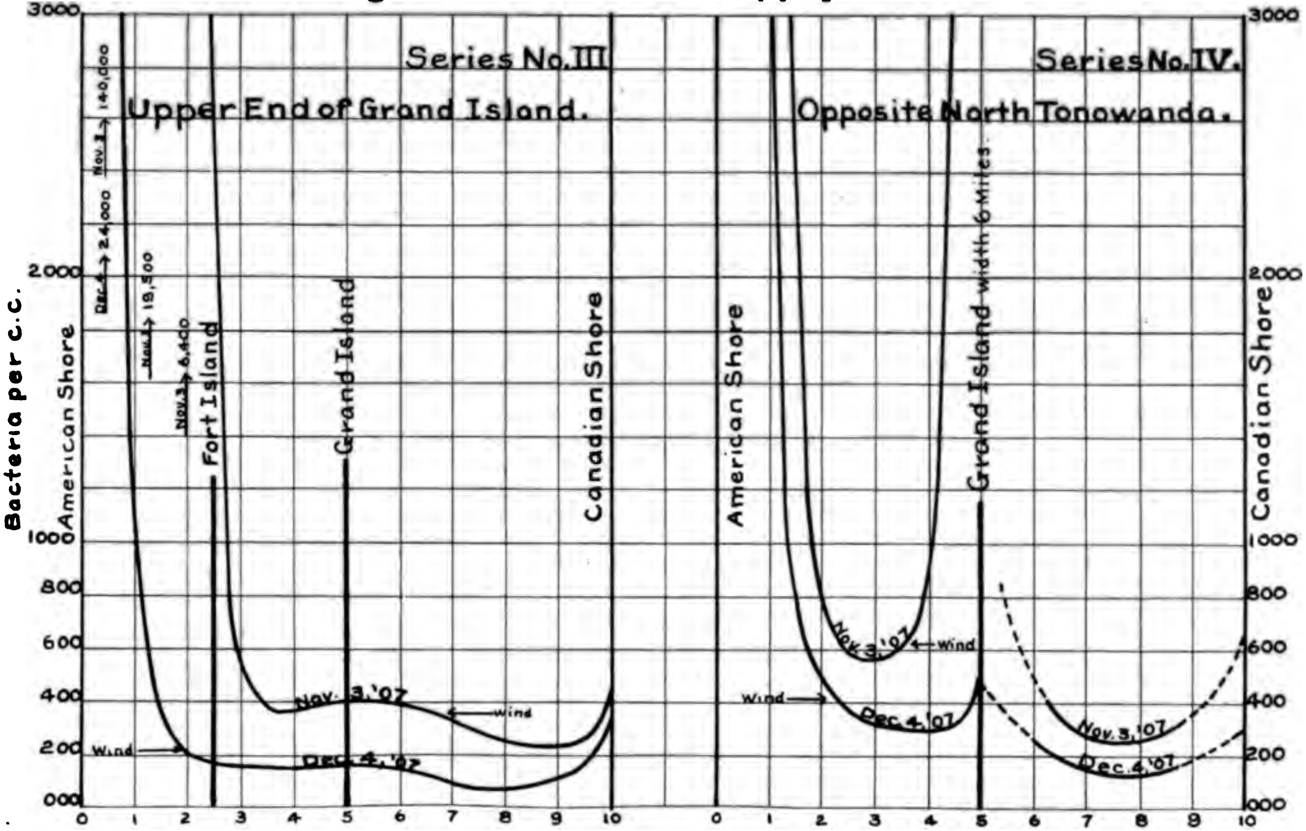
Comparing now the results more in detail, and considering first the series across Lake Erie above and opposite Buffalo, we find in both the November 3d and December 4th series evidences of considerable pollution near the American shore, both in the high numbers of bacteria, and the relatively greater presence of B. Coli. This pollution decreases, however, as we proceed from the American shore toward the Canadian shore, and when we reach points outside of the breakwater in the December 4th series, and at about midstream in the November 3d series, the numbers fall below 200; which, with no Coli present, in one cubic centimeter samples, may be considered very pure water, judged by ordinary standards, in which the numbers of bacteria range between 100 and 300 per cubic centimeter with B. Coli absent. In fact, if we except the samples Nos. 1 and 2 of November 3d, and assume that the high bacteria and presence of Coli were caused by sedimentary pollution, due to high wind on the previous day, the above statement as to satisfactory quality of water may be applicable to all that section beyond a point 25 per cent. distant from the Buffalo shore.

Considering next Series No. II, across the Niagara river just above the International bridge, we find an even greater consistency in the results, especially taken in conjunction with Series No. III, lower down the river. In this series we find again that the numbers are higher in the November 3d than in the December 4th observations, the reasons for which are the same as in the previous case. What is more marked, however, is that in this series the numbers of bacteria in the samples near the Buffalo shore, where we know, without doubt, that sewage pollution is intense, are very much higher than in the samples further out in the stream, and indicate very clearly the horizontal stratification. Thus, for each curve, the bacteria fall very sharply beyond a point 25 per cent. out from the American shore, from very high numbers ranging from 11,000 to 200,000 down to below 300 for December

Niagara Falls Water Supply, Jan. 14, 1908.



Niagara Falls Water Supply, Jan. 14, 1908.



4th, and below 500 for November 3d. Again B. Coli are not present in one cubic centimeter samples in any of the December 4th series, beyond the 25 per cent. point from the Buffalo shore, and in only one of eight of the one cubic centimeter samples on November 3d beyond the 25 per cent. point. In other words, the B. Coli determination also clearly establishes the well-defined horizontal stratification at this section, showing that beyond a point 25 per cent. distant from the Buffalo shore, the water in the river is not affected by the Buffalo sewage. The general higher bacteria, and presence of B. Coli, in the November 3d series, are, in my opinion, explained by the same wind action described above for Series No. I — the general quality of the lake water being affected at these times of wind action, and in turn imparting the pollution to the water of Niagara river.

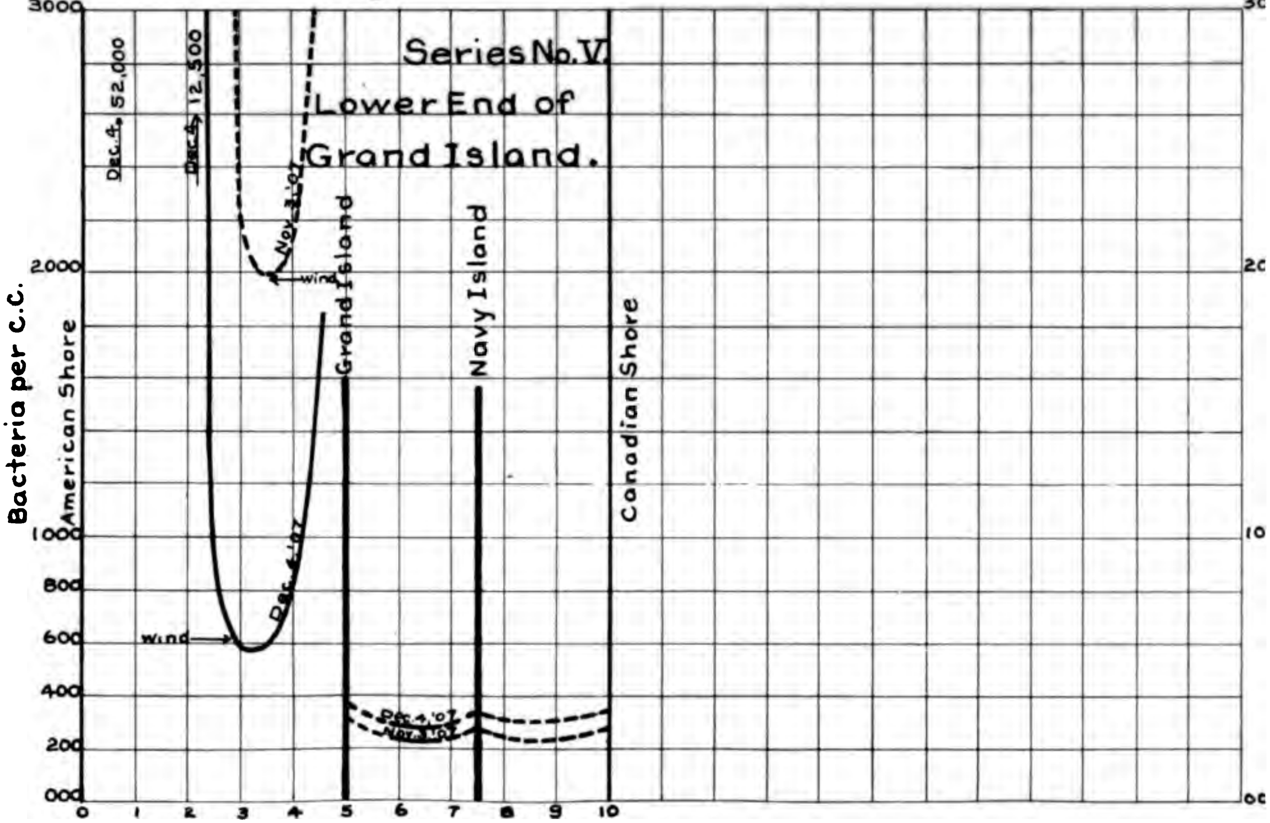
The next series, No. III, was taken at the head of Grand island, where the river divides and forms the American and Canadian channels proper. It is evident that at this point the water of the river is effectually divided by this island, and is kept so for the remaining portions of their respective courses down to the lower end of Grand island, at the proposed intake of Niagara Falls; and that, if the water in the Canadian channel, at the head of Grand island, is *not* affected by the sewage of Buffalo it will *continue* to be free from this pollution for the remainder of the distance, and be subject to *only* such local pollution as may come from the west shore of Grand island and the Canadian shore. It is evident, then, that this series, No. III, is the most important one and will, therefore, be carefully described.

This series of samples shows, in a very marked and consistent manner, the horizontal stratification, and relative purity, of the river water which was shown generally, but with less consistency, in the series at International bridge and above Buffalo. Thus on the profiles, to which attention is particularly directed, it will be seen that the water section comprises three channels: One between the American shore and Frog island; one between Frog island and Grand island; and one between Grand island and the Canadian shore. The bacteriological profiles show that, between the American shore and Frog island, nearly all of the sewage of Buffalo passes — the numbers of bacteria being excessive on both dates and amounting to from 6,000 to 19,000 for December 4th, and from 24,000 to 140,000 on November 3d. In the second section, between Frog island and Grand island, the numbers have reduced to less than 200 for December 4th, and less than 400 for November 3d; while in the third section, the Canadian channel, the numbers have reduced to about 100 for December 4th, and about 300 for November 3d.

The Coli determinations follow out in a strikingly clear manner the same evidence. Thus the section between the American shore and Frog island shows the presence of Coli in all samples. Between Frog island and Grand island no Coli are found at all on December 4th, and none in one cubic centimeter samples on November 3d. Between Grand island and the Canadian shore we have again no Coli whatever in the Canadian samples on December 4th, and in only one of eight samples of one cubic centimeter on November 3d. In other words the series No. III, which is the most important one, shows the greatest evidence that the sewage of Buffalo is confined, in its travel down the river, to the section of the river within 25 per cent. distant from the American shore; and that on both dates it did not reach beyond Frog island.

The next series, No. IV, taken across the river opposite the proposed intake of the Lockport water supply, opposite North Tonawanda, indicates again clearly, by total bacteria, and the proportion of B. Coli present, that the sewage pollution of Buffalo still hugs the American shore, and that at midstream the bacteria are relatively low, being only about 300 on December 4th and about 600 on November 3d. It should be noted, however, that the bacteria in the American channel, near Grand island, on November 3d, were quite high, viz., 4,500, which, however, was probably due to shore wash, and to the direction of the wind, which latter would carry the shore wash out into the stream. The sample in the same place for December 4th did not show these high numbers, which seems to bear out this reason. It should be further noted that the total bacteria, as well as the relative numbers of B. Coli in this series, are higher than in the preceding series, I, II, and III, and this would indicate that, notwithstanding the well-maintained horizontal stratification, there must be a slight intermingling of the Buffalo sewage at

Niagara Falls Water Supply, Jan. 14, 1908.



this point, and that the general quality of the river water here is not quite so good as at the previous section further up stream.

The last series, No. V, was taken at the lower end of Grand island, across the American channel, and partly across the Canadian channel, opposite the proposed intake of the Niagara Falls water supply. The profiles here show very clearly the continued horizontal stratification of pollution in the American channel, and the relative purity of the water in the Canadian channel, as compared with the American channel.

Considering first the American channel it is clear that the relative numbers of bacteria are again consistently higher for November 3d than for December 4th. The excessively high bacteria near the American shore on both dates — i. e., 52,000 on November 3d and 12,500 on December 4th — show that the Buffalo sewage, even at this distance, and notwithstanding the tortuous channel, still hugs the American shore. The relatively higher total bacteria and greater number of B. Coli in this series, as compared with previous series, I to IV inclusive, again show — and to a greater extent — that the sewage of Buffalo has to a rather marked degree intermingled with the river water, and that some sewage pollution undoubtedly reaches entirely across the American channel at this point.

Referring to the Canadian channel, between Grand Island and Navy island, however, we see at once that the total bacteria are quite low, being about 200 and 300 per cubic centimeter, for December 4th and November 3d, respectively; and that B. Coli were not present in any of the one cubic centimeter samples on either of these days; and in only one out of six ten centimeter samples, on November 3d. No samples were taken from the Canadian channel between Navy island and the Canadian shore, but there is no evidence or reason to believe that any greater numbers of bacteria, or presence of B. Coli, should occur in the Canadian section, than in the Grand Island section of this channel.

In view then of these extended series of observations and the foregoing statements we may conclude:

1. That the discharge of the sewage of Buffalo into Niagara river highly pollutes the waters of Niagara river near the American shore, at least as far down as Niagara Falls.

2. That, owing to the great width and rapid velocity of flow in the river, a very marked horizontal stratification takes place, the effect of which is to prevent the sewage from effectually intermingling with the currents in the river for a greater distance from the American shore than about one-fourth the width of the river, and for a distance down the river at least as far as the head of Grand Island. At this point the river is effectively divided, and as a result of which any subsequent pollution in the American channel would not in any way affect the purity of the waters of the Canadian channel.

3. That the effect of high winds from the southwest, when the lake level at the Buffalo end is higher than the mean level, is not sufficient to carry to any great extent, by subsurface currents in the lake, the sewage from the Buffalo shore out into Emerald channel nor to any extent beyond the Emerald channel. This is owing, in all probability, to the accelerated currents induced in the Emerald channel, both in the lake and in the river, when the water level at the lower end of the lake is raised through wind action; these accelerated currents tending to intensify the horizontal stratification after the lake water has once entered Niagara river.

4. That owing to this horizontal stratification, the portion of the waters of the lake which travel down Niagara river and enter the Canadian channel are kept free from the pollution of Buffalo sewage under conditions of direction of wind that occurred on November 3d and December 4th, when it was from a generally easterly and a generally westerly direction, respectively.

5. That considering the relative slight changes in the horizontal stratification, due to opposing directions of wind, as occurred on November 3d and December 4th, there is little likelihood that with greater intensities of wind, or with the same or different directions, this horizontal stratification would be sufficiently interfered with to result in any appreciable pollution of the Canadian channel by the sewage of Buffalo.

6. That in the American channel below the head of Grand Island for a considerable difference there is still maintained a horizontal stratification, though to a less marked degree; but that as far down as the lower end of Grand Island the inter-

mingling of the sewage of Buffalo with the water of the river has progressed to a point where the entire section of the American channel is considerably polluted.

7. That the water in the Canadian channel is kept in its original Lake Erie purity as far down as Navy island, except for the pollution from the shores of Grand Island and the Canadian shore, and from boats in the river, or accidental pollution.

8. That any supply taken from the *American* channel near the lower end of Grand island should be first purified before being used for domestic purposes.

9. That any supply taken from the Canadian channel opposite the lower end of Grand island, if unpurified, should be taken from a point between Grand island and Navy island to avoid, so far as is possible, any pollution from the Canadian shore.

10. That an unfiltered supply taken from this latter point should compare favorably, and if shore pollution from Grand island and from steamboats is eliminated, almost equally with any supply taken from the lower end of Lake Erie, above the influence of the discharge of Buffalo sewage.

11. That the water of Lake Erie before it passes into Niagara river is occcasionally affected in its sanitary quality and turbidity by wave action upon the sediment at the bottom of the lake during times of high and continued winds, but not to seriously affect its general potability.

12. That the quality of Lake Erie water and of the water of the Canadian channel, taken at the lower end of Grand island between it and Navy island (with the limitations stated above as to local pollution) is of a *reasonably safe* and *generally satisfactory quality* for a potable supply, judged from a sanitary as well as a chemical standpoint, and as compared with the average of the good unfiltered surface supplies of the country. It is, however, at times subject to occasional turbidity and slight contamination, due to wind action in stirring up the sediment on the bottom of the lake, which, however, is not of a serious nature under present conditions of population along the shores of the lake and Niagara river. A supply taken from the point in the Canadian channel above described would, however, if protected from the local pollution along Grand island, compare favorably

if not equally with the supply taken from the new proposed intake of the Buffalo water supply.

In view of these conclusions I am of the opinion that the city of Niagara Falls is well justified in undertaking to secure an unfiltered supply from the Canadian channel between Grand island and Navy island. And that whereas this supply would not be as pure as a filtered supply from this source, or from the American channel at this point, it would be of a generally satisfactory quality, should reduce the typhoid fever death rate of the city to a nearly if not quite normal figure, and would enable the city to benefit by the saving in the cost of an unfiltered supply from this source over the cost of a filtered supply taken from the same source or from any other point in Niagara river. I am also of the opinion that whereas an unfiltered supply, taken from the proposed point, may serve as a reasonably safe and satisfactory supply at the present time and for a few years in the future, it will *ultimately* be necessary for the city to filter this supply, and further to take all necessary precautions to prevent local pollution along the westerly shore of Grand Island, and to take measures to secure suitable land and make other necessary provision for a future filtration of the supply.

Very respectfully,

THEODORE HORTON,

Chief Engineer.

INVESTIGATION OF SEWAGE DISPOSAL PLANTS

ALBANY, N. Y., *December* 1, 1907.

EUGENE H. PORTER, M. D., *State Commissioner of Health,*
Albany, N. Y.

DEAR SIR:— I have the honor to transmit the accompanying report of Prof. H. N. Ogden, Special Assistant Engineer, covering a description of the sewage disposal plants which have been constructed and are in operation in the State of New York.

This report may be considered a progress report of a general and more comprehensive investigation which you have directed me to have carried out by the engineering division, covering not only an examination and description of the constructive features of these plants, but also their operation and efficiency of purification. The accompanying report, then, covers only the descriptive work which it was possible to accomplish with the limited engineering assistance available during the season of 1907, and leaves as the future work of this investigation an examination of these plants with respect to their operation and purifying efficiency.

The majority of these plants were examined by Mr. C. L. Walker, Special Engineering Inspector of the Department, and the descriptions in the accompanying report were prepared largely by him. Some of the plants were examined by other members of the engineering staff, and a few of the descriptions were abstracted from reports of engineers who have designed or constructed the plants. The photographs in all cases, except for Ballston Spa, Saratoga and Montefiore Sanitarium, were taken by Mr. Walker on the ground at the time of his visits, and the block plans were with few exceptions from his notes.

This report is one of the more important of the special reports that have been prepared by the Engineering Division, and it will, I believe, commend itself not only to engineers and sanitarians but to all others who are interested in the present movement for extending sewage purification in this and other States. It will be of especial value to this Department and its Engineering Division in its more responsible work of protecting our streams from sewage pollution, and will add appreciably to the knowledge and advice that the Department will be able to offer municipal authorities and owners and managers of industries and public institutions in the solution of their problems of sewage disposal.

Respectfully yours,

THEODORE HORTON,
Chief Engineer

ALBANY, N. Y., *December* 1, 1907.

Mr. THEODORE HORTON, *Chief Engineer, State Department of Health, Albany, N. Y.:*

DEAR SIR:— I beg to submit herewith a report on the sewage disposal plants in the State of New York accompanied by certain photographs and block plans of the same.

The results of the inspections of these plants show that there are in the State, insofar as is known, fifty-five, more or less complete, sewage disposal plants. Of these, twenty-nine are for the disposal of municipal sewage, the size of the municipality varying from the New York chemical disposal plants, with a flow of 10,000,000 gallons per day, to one of the small plants at Stamford, with a flow of a few thousand gallons per day.

There are also twenty-six, more or less complete, plants for the disposal of sewage from institutions, such institutions including the summer schools at Chautauqua and Lilly Dale, the Manhattan Beach hotels, such institutions as hospitals, asylums, almshouses, sanitariums, and such private institutions as milk stations. In both cases the disposal plant is either complete, i. e., a method of treatment which involves an attempt to oxidize the organic matter, or is of the incomplete type in which sedimentation alone is used, and where no oxidizing opportunity is given.

The complete municipal plants include the following, and the partial treatment plants are given in a second column.

Complete Municipal.

Ballston Spa
Brewster
Briarcliff Manor
Brockport
Dansville
Depew
East Syracuse
Elmhurst
Garden City
Lake Placid
Liberty
Matteawan
Penn Yan
Saratoga
Tuckahoe

Incomplete Municipal.

Bronxville
Coney Island
Corinth
Dolgeville
Far Rockaway
Ithaca
Jamaica
Kingston
New Lotts
New Rochelle
Saugerties
Skaneateles
Stamford
White Plains

The municipal plants may be divided as follows:

Sedimentation and contract beds, 7; sedimentation followed by filtration, 5; irrigation, with or without sedimentation, 2; sedimentation and shallow aërating beds, 1.

The works for the partial treatment may be divided as follows:

Simple sedimentation which may or may not involve septic action in the residue, 8; sedimentation occasioned by the addition of chemicals, 6.

The plants at institutions may be divided as follows:

Institutions Complete

Albion
Bedford, Montefiore Home
Central Islip State Hospital
East View
Fair Haven
Glen Haven
Jamesville
Lebanon Springs

Vassar College
Ray Brook Sanitarium
Rye M. O. House
Rye Public School No. 3
Sonyea
Thompson's Ridge
Valhalla

Institutions Incomplete.

Alfred University
Batavia
Bath
Chautauqua
Hudson School
Lilly Dale
Manhattan Beach Hotels
Nanuet
Onondaga County House
Pine Bush
Round Lake

The institutions which have complete treatment for sewage may be divided as follows:

Sedimentation and contact beds, 6; irrigation, with or without sedimentation, 5; sedimentation followed by filtration, 3; sedimentation and sprinkling filters, 1.

The institutions which have partial treatment may be divided as follows:

Sedimentation, with or without septic action, in the residue, 8; sedimentation by the addition of chemicals, 4.

The following points of interest may be noted:

The complete treatment of municipal sewage is comparatively recent, since among the sixteen plants which are noted, the oldest, that at Brewster, was constructed in 1893, that plant, however, not representing modern ideas of treatment, and the oldest plant involving modern notions was that of Liberty, built in 1900, all the others having been built since that time.

The plants for the partial treatment, however, are much older, those involving chemical treatment dating back to about 1890.

Examples of the best type of plant for partial treatment may be found at Dolgeville, Saugerties, Bronxville and Skaneateles, while examples of the better type of complete treatment may be seen at Ballston Spa, Brockport, Dansville and Penn Yan. The plant at the Montefiore Home, with its sprinkling filters and supplemental settling basins, is representative of the highest and most modern ideas in the art of sewage disposal, and has the distinction of being the first complete plant of this type which has been constructed and put in regular service in America. The plants at Lake Placid and at Saratoga, which include sand filters, are types of disposal plants which perhaps will give the greatest bacterial efficiency but, unfortunately, these are confined to localities where sand can be found " in situ."

A description of the plants will now be given, arranged in alphabetical order, with the block plans and photographs accompanying each description:

ALBION, WESTERN HOUSE OF REFUGE FOR WOMEN

The Western House of Refuge for Women, with its sixty-two acres of farm land and nineteen acres on which the building stands, is located at Albion, N. Y., a village situated in the northern and western part of the State and about nine miles from Lake Ontario. The village has a population of 5,200.

The water supply for Albion and for the House of Refuge is furnished by a private company and is obtained largely from twelve artesian wells, each having a depth of 120 feet. In times of dry weather this supply is supplemented by water taken from Otter creek, three miles from Albion. The water from Otter creek is led by pipe to a filter bed of sand ten to twelve feet deep, 100 feet long, 50 feet wide and about 250 feet from the artesian wells. From this bed it is supposed to filter into the wells. The water from the wells is collected in reservoirs and is pumped to the Albion Water Company's stand pipe from which point it is supplied to the House of Refuge by gravity. The water taken from Otter creek has a disagreeable taste rendering the supply undesirable; that taken from the wells is good. The daily supply to the House of Refuge is 15,160 gallons or sixty-three gallons per head per day. About one-third mile of pipe conveys the water to the buildings of the House of Refuge, twelve of whose buildings have been connected.

The sewer system and disposal plant were built in 1898 and the present population connected with the system is 240, about twenty-three of whom are officers of the institution The sewage is purified at present by partial aëration and filtration, though when the plant was designed purification was to be effected by thorough aëration combined with filtration. The sewerage system has a length of 3,500 feet and receives sewage from fourteen buildings. These buildings are used either as dormitories, school-rooms or workrooms and furnish a domestic sewage. The system is not underdrained.

The sewage first passes through a screen chamber containing two screens. The first is one of inclined circular, one-fourth inch rods, spaced about three-fourths inch to one inch; the second screen is of woven wire with about three meshes to the inch, both vertically and horizontally.

From this screen tank the sewage flows upon the surface of the strainer beds, there being three of these beds, four and one-half feet deep, and each bed being made up of two compartments separated by a wall having about eight openings, the size of a brick, at the bottom. The sewage flows downward through the first compartment of the bed and upward through the second compartment of the bed. In the first compartment a large uniform sized coke is used, the coke being of the size of furnace coal and having a depth of three feet. The second compartment contains a coke of about the size of pea coal and of the same depth as the coke in the first compartment.

From the strainer beds the sewage flows over a weir into an open four inch channel built in the top of the concrete covered division wall between the aërating beds, two in number, and the strainer beds. From this open channel the sewage flows the length of the aërating beds through one of the two perforated copper gutters hung along one side of the bed, by means of which it is distributed over the surface of the aërating beds. After filtering through the aërating beds the sewage collects in the outlet chamber through which it discharges in a steady stream to the discharge pipe. After flowing through 720 feet of this pipe the sewage empties into a small unnamed stream just before it passes under the Erie canal.

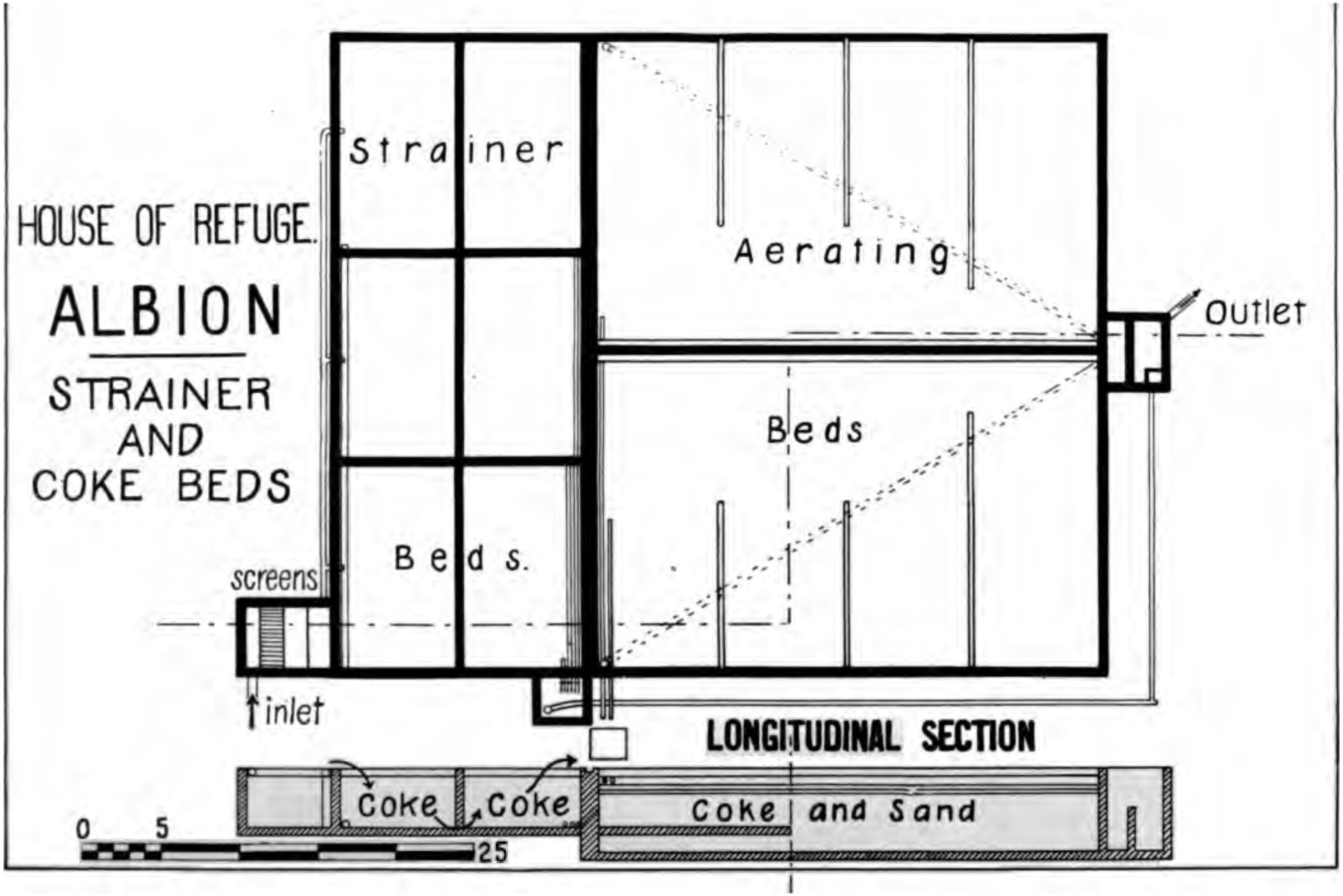
The aërating beds are filled with coke, gravel and sand, and in order given, from the bottom of the beds upward. The coke is four and one-half feet deep, the gravel three inches and the sand four inches deep.

As originally designed, air was to be forced through the strainer and aërating beds to assist in the oxidation of the organic matter in the sewage, but for more than a year past no air has been pumped into the beds.

HOUSE OF REFUGE.

ALBION

STRAINER
AND
COKE BEDS



The strainer beds are small and in three weeks' time have a depth of three inches of sediment on their surface, resembling fine ashes in appearance. Usually, these beds are cleaned once in three months but often it is longer. If the air pump were used daily, and if the straining beds were cleaned once every two weeks objection to the plant would probably cease, or at least decrease. On July 11, 1907, there was a decidedly unpleasant odor in the vicinity of the beds. The enlarging of the perforations in the copper gutters would, probably, result in a more thorough distribution of the sewage over the aërating beds.

At the outlet end of the sewer the invert of the outlet pipe is three and eight-tenths feet above the bottom of the culvert leading the small stream under the canal. Except in times of very hard rains this would leave the outlet pipe free from back water.

To maintain the plant as at present operated the services of the caretaker are required on an average of two hours each day. To replace the coke taken from the beds in cleaning ten tons are required annually.

Annual cost of operation.

Services of caretaker at $7 per month	$84 00
Ten tons of coke at $5 per ton	50 00
Total annual cost	$134 00

ALFRED

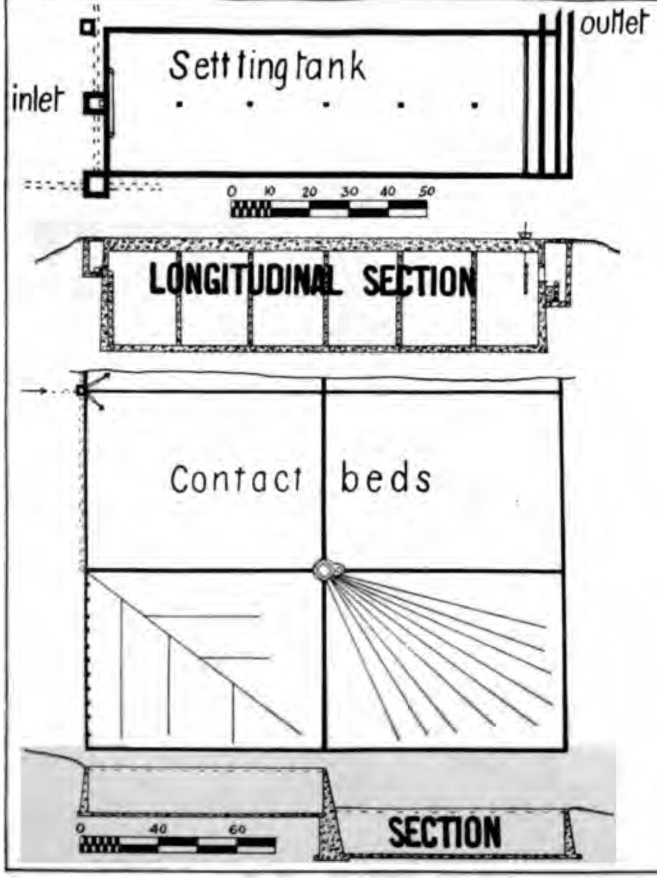
About ten miles south and west of Hornell and in the village of Alfred is located Alfred University. The village is not situated near any large body of water, its drainage flowing through small streams, through Canacadea creek and Canisteo river into Chemung river. The population of the village is about 950, and the average attendance at the University is 300.

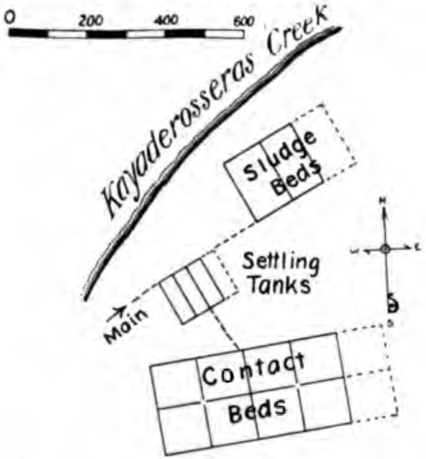
The water supply is obtained from springs and from two wells and flows by gravity to a storage reservoir. From this reservoir it is distributed to the town through four and one-half miles of pipe ranging from two inches to eight inches in diameter. The University has on the campus a well drilled to a depth of 185 feet in which the water rises to within thirty-five feet from the top. For a time the water was pumped from this well with electrical power, but at present a 100-barrel storage reservoir has been built at a lower point on the campus and the water carried to it from the well by means of a siphon. At the close of the day there is usually little more than three feet of water in the reservoir but before morning it is filled again.

The sewage of both the University and the village is collected, where privies are not used, in cesspools. There are seven of these pools owned by the University and about three by the people of the village. The pools are so constructed that they have two chambers separated by a porous wall. The sewage enters one chamber and the liquid portion percolates into the second chamber from which it discharges upon the soil. As constructed these pools cost in the neighborhood of $100 apiece.

BALLSTON SPA

Ballston Spa is a village of about 6,000 people situated on the Kayaderosseras creek about four miles from Saratoga lake. The domestic sewage for purposes of the design was estimated at 500,000 gallons, in addition to which 400,000 gallons of tannery wastes entered the sewers, possible filtration bringing the total estimated daily flow of sewage up to 1,000,000 gallons per day. The plant is of particular interest from the fact that nearly one-half of the daily flow is of factory waste of a kind usually considered difficult to handle. The sewage is delivered from the village to a receiving tank on the outskirts, the capacity of the tank being one-quarter of the day's flow. It is 70 feet in diameter, 9 feet deep and divided into two equal compartments by a concrete wall extending from floor to roof. In this way either one or both compartments may be used at will. The suction pump is built on the side of the circular well and is 12 by 24 feet and 8 feet deep. A single-action plunger pump forces the sewage from this well to the settling tanks, which are 2,700 feet away and on the top of a hill about ten feet higher. The settling tanks are three in number, so arranged that they may be operated singly, in sets of two, or all at the same time. Each tank is 111 feet long, 35 feet wide and averages 7½ feet deep, containing 218,000 gallons. The pump well, holding sewage about three hours, delivers





BALLSTON SPA

SETTLING TANK

AND

CONTACT BEDS

BALLSTON SPA. RECEIVING BASIN AND PUMP WELL.

BALLSTON SPA. SECONDARY CONTACT BEDS.

the sewage to these tanks already partially septicized, and with only one of the tanks in action an eight-hour period is obtained, and with the three tanks in operation a detention period of not far from twenty-four hours can be counted on. The force main enters a concrete manhole at the tanks and from there is led by a twelve-inch pipe into the tanks, two openings being provided for each tank. No baffle walls are provided at the inlet end, but a movable baffle wall operated by screws is provided about four feet from the outlet end. Each tank is provided with a twelve-inch sludge valve and sludge pipe connection, opening out onto sludge tanks behind the tank. The outlet weir is of stone, eighteen inches wide and two inches thick, built into the end concrete wall with a slope of one inch outward. Just behind this outlet weir and following the outlet channel, which is two feet wide and two feet deep, is a deposit of coke breeze filter. This coke bed is intended to arrest the progress of particles in suspension which pass out from the settling tanks, and to that extent protect the contact beds from clogging. It is also stated that this coke bed will act as an aërator and start the oxidation of the effluent.

From the settling tanks the sewage passes to the contact beds, of which there are four primary and four secondary. The effluent from the tanks flows directly to the gate chamber of the contact beds through a twelve-inch vitrified pipe sewer. The gate chamber is four feet square and has four bronze mounted valve gates which control the flow of sewage to the four primary contact beds. These beds are each 120 feet long, 90 feet wide and 6 feet deep. The contact material is broken field stone of a hard and crystalline character like granite and very uniform. The depth of this material is five and one-half feet. The under-drainage of the beds is secured by a series of nine lines of five-inch horseshoe tile underdrains laid on the concrete floor and radiating toward the center, at which is the gatehouse. The gates of the valves, which control the emptying of the primary beds as well as the emptying and filling of the secondary beds, operate by hand. There is a float gauge with an indicator in the gatehouse which shows the level of the sewage in the bed. A twelve-inch gate valve opens and shuts to control the flow from the beds. It is estimated that each bed will hold 130,000 gallons of sewage independent of the contact material.

The illustrations are given through the courtesy of the secretary of the American Society of Civil Engineers and show the pump well and the settling tanks in process of construction and also two views of the contact beds, one with the secondary beds empty and one with the beds partly filled.

BATAVIA

New York State School for the Blind

Located in the village of Batavia is the New York State School for the Blind. The school is situated on an eminence just outside of the village and during the school year has an average attendance of 200. Of this number about 150 are pupils. The drainage of the village and of the school flows through Tonawanda creek and Tonawanda river into the Niagara river.

The water used in the school is supplied by the village of Batavia and approximately 20,000 to 30,000 gallons are furnished daily. In the neighborhood of two miles of water piping is required to distribute and carry this water to the five buildings, which have been connected.

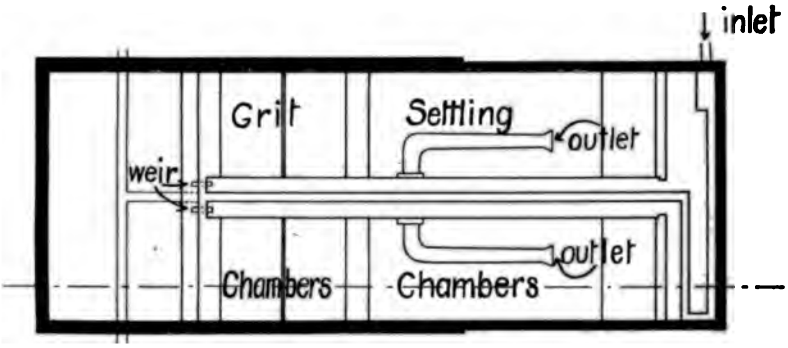
The sewerage system was built in 1890 and contains about one mile of sewer pipe. A building has been erected over the chambers, which have been arranged for treating the sewage chemically. Five of the ten buildings of the school have been connected to the system and furnish only a domestic sewage. The sewer system is not underdrained and the plant cares for the sewage of the entire attendance.

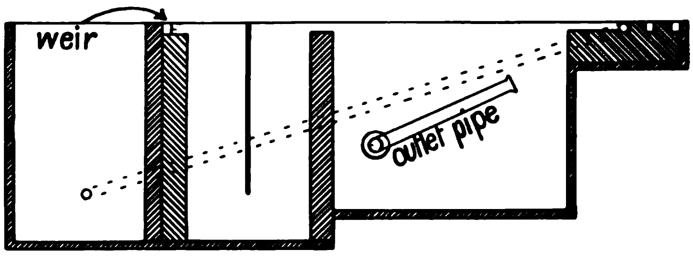
At the present time the sewage enters the disposal house and after flowing through forty feet of six-inch channel and making five ninety-degree turns it falls over the lip of an eighteen-inch weir into a receiving or grit chamber that is eight feet long, six feet wide and about fourteen feet deep. Across the middle of this chamber is placed a wooden gate which extends some six inches above the surface of the sewage, which reaches to within three feet of the bottom of the chamber and which serves to re-

N.Y.S. SCHOOL FOR BLIND

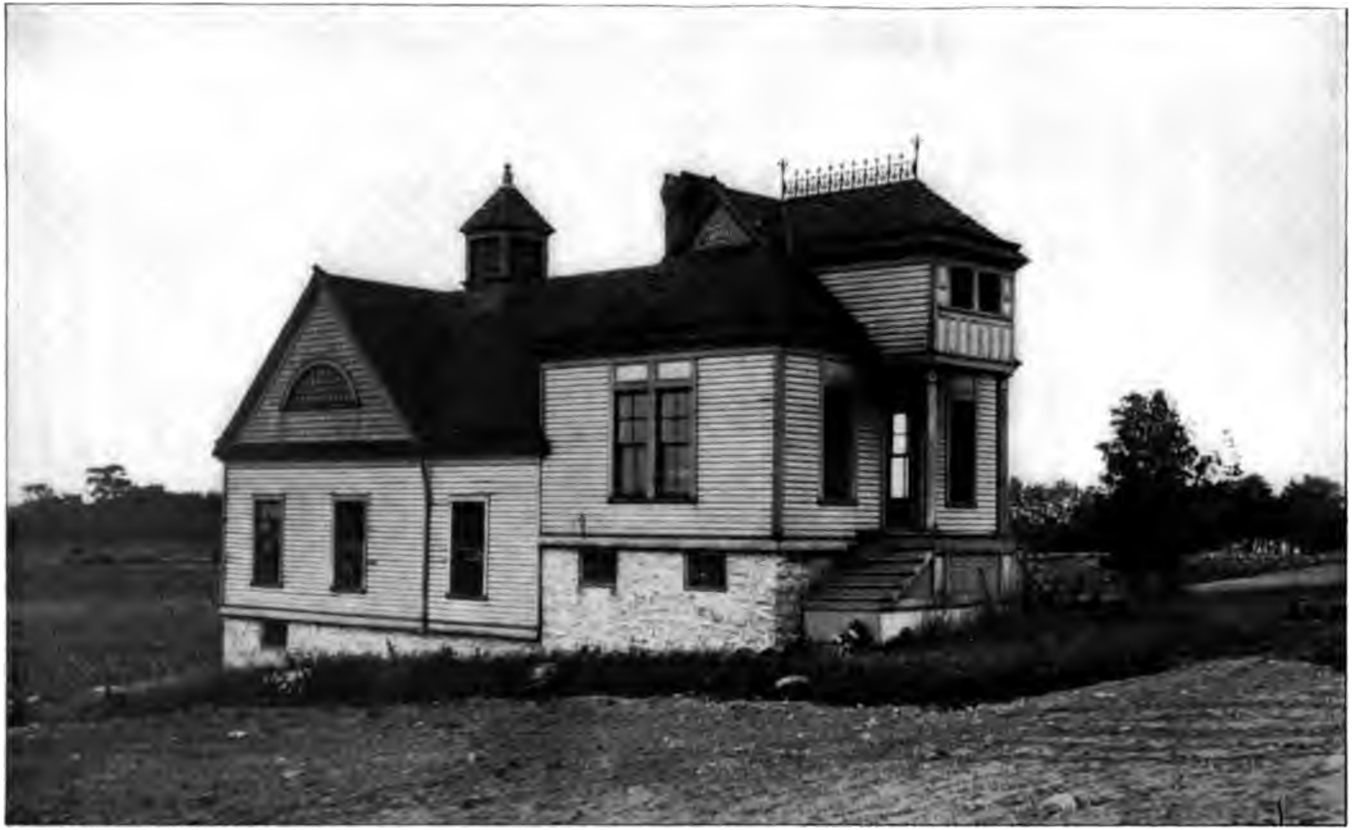
BATAVIA

CHEMICAL PRECIPITATION





LONGITUDINAL SECTION



BATAVIA. CHEMICAL PRECIPITATION PLANT.

tain the floating matter and to induce sedimentation. From this grit chamber the sewage flows over a second eighteen-inch weir into a settling chamber seventeen feet long and six feet wide, after which it passes over a third eighteen-inch weir and falls three inches into an open channel six feet long, which carries the effluent to the discharging pipe. The chambers are built in duplicate so that one set of chambers may be thrown in or out of use at any time. The discharging pipe is laid in the wall separating the two sets of chambers directly beneath the open channel through which the sewage flows upon first entering the disposal house.

From the disposal house the sewage flows through about three-quarters of a mile of eight-inch to ten-inch pipe into Tonawanda creek. The outlet end of this discharging pipe empties into an uncovered masonry manhole. The channel leading from this manhole is partly closed and the falling of rock and soil tends constantly to close the channel as well as to fill the uncovered manhole. At one time last year material collected to such an extent that the outlet pipe was closed completely.

Samples of the effluent taken from a manhole about midway between the receiving and the outlet ends of the discharging pipe showed putrescibility in sixteen hours. The effluent was clear but had an unpleasant odor.

Originally the purification was brought about by introducing into the sewage a solution of alum. This solution was mixed in a barrel and allowed to feed from a tap into the sewage as it entered the purification chamber. The filling of this tap by the alum has caused its use to be discontinued and for three years the sewage has received no chemical treatment whatever.

The concrete lining of one set of chambers is scaling so badly that the use of this set of chambers has been discontinued, and the sewage now runs constantly through one set of chambers without, as before stated, receiving any chemical treatment.

About one hour is required in washing the chambers, which is done every two weeks. At each cleaning the solid matter is from two and one-half to three feet deep and about three loads of solid matter are washed upon the sludge area, distant from the disposal house and back of it about 300 feet. It is carted away from here three or four times a year and used as fertilizer. When the sulphate of alumina was used it was used at the rate of ninety-two pounds per month, or three pounds per day, and was bought at the rate of $1.90 per 100 pounds.

The illustration shows the building, which covers the whole plant.

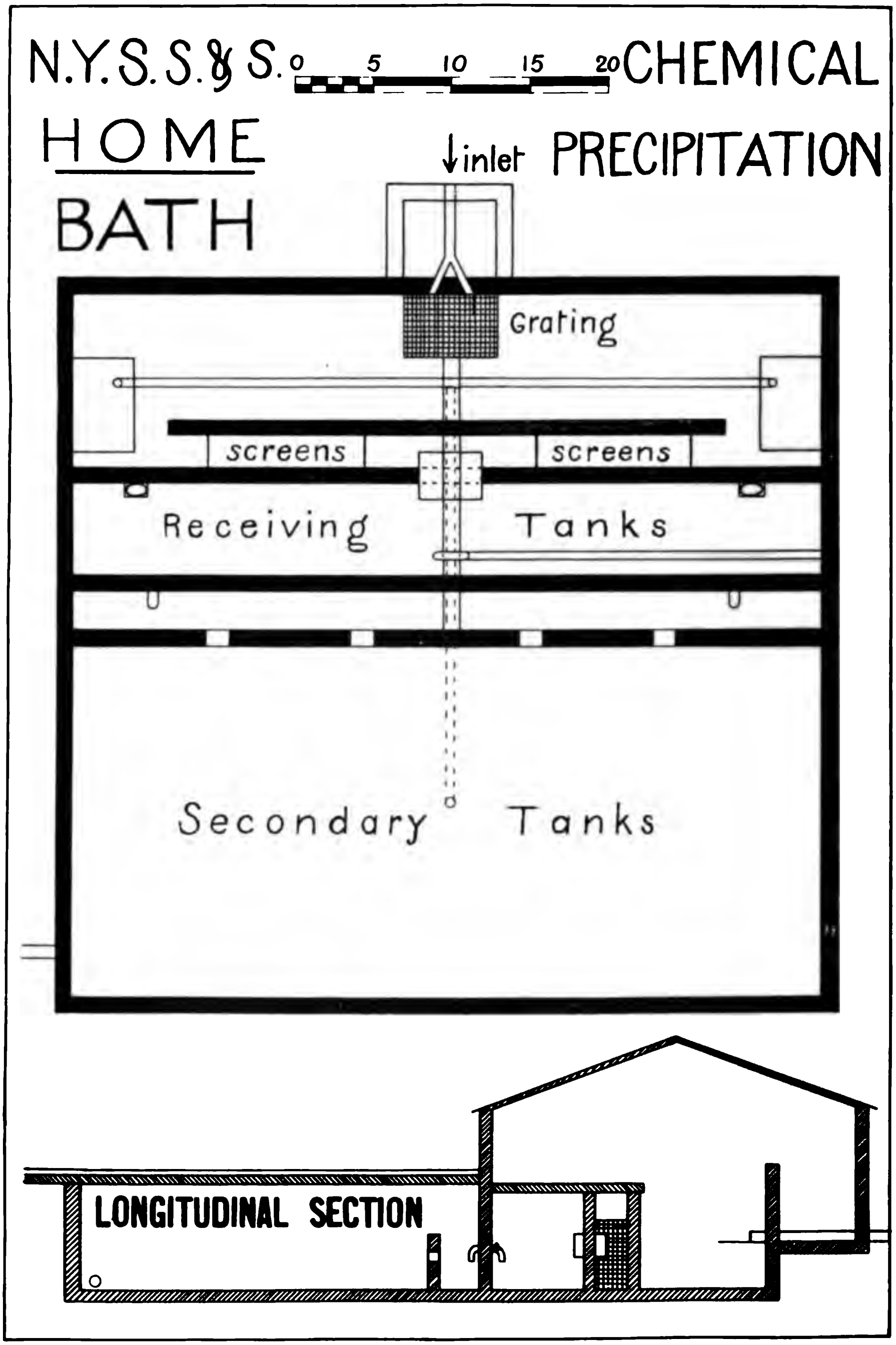
BATH

New York State Soldiers and Sailors' Home

The New York State Soldiers and Sailors Home is situated about one and one-half miles north of the village of Bath, and lies in the Chemung valley, about eight miles southwest of the southern extremity of Keuka lake. The attendance at the Home ranges from 1,800 to 2,200, with a yearly increase of about fifty, the maximum attendance being attained February 1st, and the minimum about June 1st.

The water supply is obtained from two 105 feet artesian wells in the valley, and from springs on the hillside above the commanding officer's residence. About 200,000 gallons of water are used daily, or an average of about 100 gallons per head per day. Of this amount two-thirds is obtained from the wells and the remainder is obtained from the springs. In times of heavy rains, though the receiving area of the springs is kept well cleaned, the spring water has an unpleasant taste and it is intended soon to sink a third well in the valley. The two wells have been used continually for fifteen years and the flow from them has at all times been good.

The sewage system was built in 1889 and has been used constantly since that time receiving the sewage from all of the inmates of the Home. The sewage is purified chemically, fifteen bags of lime and 1,000 pounds of sulphuric acid being used each month, or one-half bag of lime and thirty-three pounds of acid daily, to effect the purification. Thirty-five buildings, either barracks or workshops of the Home, have been connected to the system. A barn, housing twelve to fourteen horses, is also connected with the system but the excreta is removed from the barn every day or every other day. The sewage from the commanding officer's residence and from the six homes of civilian officers


N.Y.S.S.& S.
0 5 10 15 20
CHEMICAL
PRECIPITATION
HOME
BATH
inlet
Grating
screens
screens
Receiving Tanks
Secondary Tanks
LONGITUDINAL SECTION

empties into cesspools. The entire sewage system is underdrained and a separate storm system is used. It comprises one and five-tenth miles of pipe and the chemical precipitation tank which treats about 150,000 gallons of sewage, or seventy gallons per head per day.

The sewage, which is domestic, enters the receiving tank through an eight-inch pipe, and flows over a cast iron grating about three and one-half feet from the bottom of the tank. This grating has half-inch square openings between flat one-inch by one-quarter inch bars. There are two of these receiving tanks 20 feet by 24 feet by 9 feet, the sewage flowing into them alternately for twenty-four hours. The line is placed on the grating at the outlet of the supply pipe before sewage enters the tank, being washed into the tank by the sewage as it enters. The sewage accumulates in the receiving tank until a depth of about three and one-half feet is reached when it overflows to a secondary settling tank 15 feet by 50 feet by 7 feet. In flowing from the supply tank to the secondary settling tank the sewage passes through two gratings, the first being made of vertical wrought iron bars three-eighths of an inch in diameter and spaced one inch on centers, and the second being made of three-sixteenths of an inch material woven so as to have a half-inch mesh both vertically and horizontally. Coarse floating material is prevented from passing the first screen by a sheet-metal apron hung at the elevation of the surface of the sewage. From the secondary settling tank, which is connected with the receiving tank by a valve, the sewage flows to a distributing tank. Originally the sewage accumulated to a depth of nearly three feet in the distributing tank before siphoning into the discharge pipe, but at the present time the walls of the distributing tank are in such poor condition that the sewage is allowed to pass directly through to the discharge pipe. The discharge pipe is about one-fifth of a mile long and empties into the Chemung river. After the sewage has been flowing into one of the receiving tanks for twenty-four hours the flow is diverted to the other and the sulphuric acid is then added to the highly charged sewage in the receiving chamber. After thorough stirring, and after standing for one hour, the sewage and accumulated sediment is pumped by a centrifugal suction pump a distance of 150 feet upon a sludge bed. The valve connecting the receiving and secondary settling tanks is opened and the weaker liquid of the secondary settling tank assists materially in diluting the sediment of the receiving tank to such a condition that it may be pumped. From the sludge beds the liquid matter filters into a small catch-basin and is carried about seventy-five feet by a six-inch pipe to the distributing tank where it mingles with the effluent from the secondary settling chambers.

There are two sludge beds, irregular in outline, and having a combined area of about one-tenth of an acre. They are earth basins surrounded by a ditch into which the liquid part of the sewage filters, and by which it is carried to the catchbasin. The solid matter is allowed to accumulate in each bed for six months and is then removed and used as fertilizer. About eighty-five tons of solid matter are removed at each cleaning.

The sewage, as it enters the receiving chamber, is nearly colorless, is very weak and has but a slight odor. When it enters the distributing chamber it is clear and without sediment or odor. Two samples of the effluent taken at the distributing chamber, however, showed signs of putrescibility in twenty-seven hours. This test, however, is a severe a one as could be made, as the samples were taken in the middle of the afternoon when the receiving and secondary settling tanks were filled and when the liquid portion of the sewage was flowing directly through the plant into the discharge pipe.

The plant is cared for by two inmates of the home who usually spend each morning at the plant. The cost of maintenance for two years is given below:

Period.	Chemicals.	Repairs.	Wages.	Totals.
Oct.–Dec., 1903	$78 00	......	$45 00	$123 00
Jan.–March, 1904 ..	78 00	......	45 00	123 00
Apr.–June, 1904 ...	78 00	......	45 00	123 00
July–Sept., 1904 ...	78 00	$7 75	45 00	130 75

Total cost	**$499 75**
Deduct for 160 tons fertilizer......................	**160 00**
Net cost	**$339 75**

BATH. CHEMICAL PRECIPITATION PLANT. SLUDGE BEDS IN FOREGROUND.

Period.	Chemicals.	Repairs.	Wages.	Totals.
Last quarter, 1905..	$73 00	......	$45 00	$118 50
First quarter, 1906..	73 50	......	45 00	118 50
Second quarter, 1906.	59 60	......	45 00	104 60
Third quarter, 1906.	59 60	$59 80	45 00	164 40

Total cost	$506 00
Deduct for 180 tons fertilizer......................	180 00
Net cost	$326 00

The illustration shows the building over the screens and receiving tanks and also the sludge beds in the foreground.

BEDFORD

Montefiore Sanitarium.[1]

A sewage disposal plant has recently been completed at Bedford Station, N. Y., to purify the sewage of the Montefiore County Sanitarium, which contains some special features of interest. This institution has in general about 200 inmates and the daily water consumption is about 20,000 gallons. The disposal plant is designed to handle a sewage flow of 30,000 gallons per day, which provides for an increase to 300 inmates. The new works, which replace an old and inadequate disposal plant, comprise a two-compartment covered septic tank with two dosing chambers, three covered sprinkling filters in which the filtering material is broken trap rock, a settling basin and a series of field trenches. The arrangement of the plant, with the exception of the trenches, is shown on an accompanying drawing.

The sewage is led by gravity from the buildings through an eight-inch vitrified pipe to the septic tank in which the water level is at elevation 412. The tank is built of concrete and is eighteen feet three inches by nineteen feet in plan outside. It is divided into two equal compartments by a vertical longitudinal wall; each compartment is seven feet six inches wide, nine feet deep below the water level and seventeen feet long inside, but this space also includes in each compartment a siphon chamber, as shown in the accompanying illustrations.

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[1] Description abstracted from *Engineering Record.*

The main outfall sewer is divided outside the septic tank and an eight-inch branch leads to each tank compartment with a gate and gate box just outside the wall. The point of discharge into each compartment is near the outer side and about at mid-depth. Each compartment is subdivided into three longitudinal divisions by seven-eighth-inch hemlock baffles, which cause the sewage to travel in each compartment approximately three times the length of the tank. The combined capacity of the two compartments is about 15,000 gallons, or twelve hours' flow when the plant is operating at its nominal full capacity rate. The outside walls of the tank have a uniform thickness of twelve inches, and are reinforced near both faces with three-fourth-inch square bars placed horizontally six to twelve inches center to center. The longitudinal partition wall is fifteen inches thick and is similarly reinforced near each face. The tank floor is six inches thick and is without reinforcement.

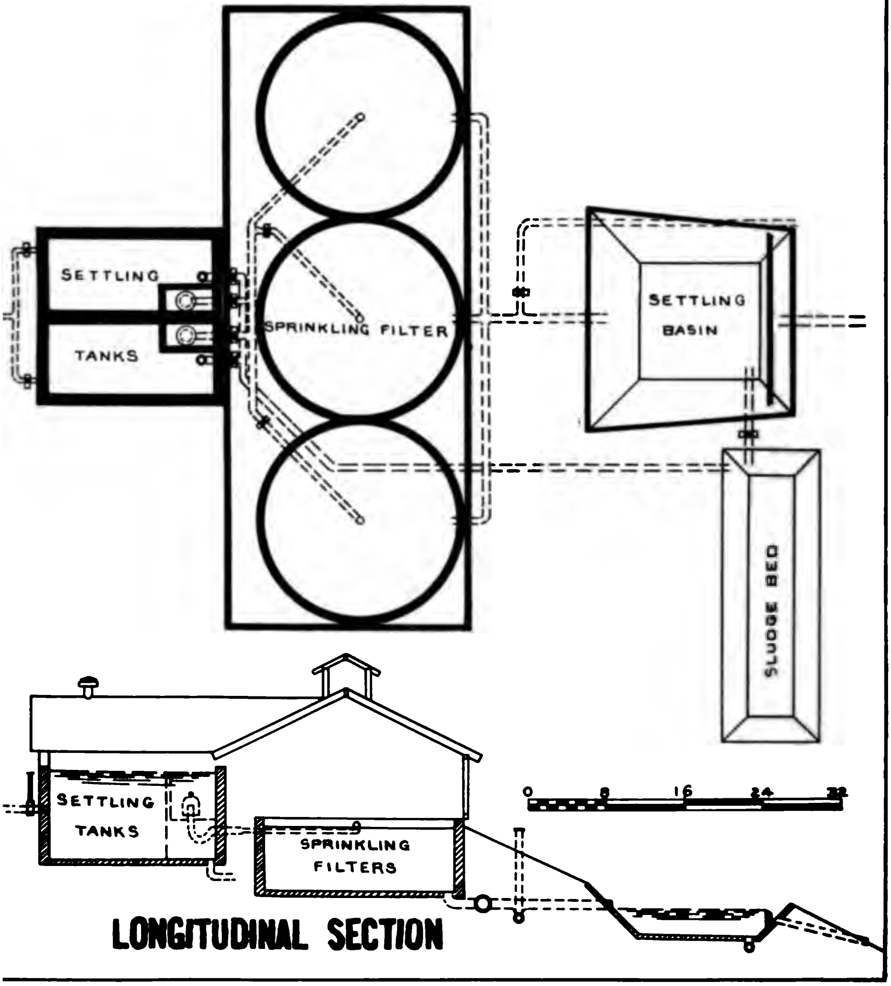
The end wall of each siphon chamber forms a weir over which the sewage flows till the level of the sewage in the chamber reaches a predetermined elevation, when the chamber is emptied by a six-inch Miller automatic siphon. Scum boards of three-fourth-inch thickness extending completely across the inlet end of the outlet compartment of the septic tanks were installed to prevent the escape of floating solid matter into the siphon chamber. The capacity of these dosing chambers is such that under ordinary operating conditions their contents will be discharged onto the sprinkling filters at intervals varying from ten to twenty minutes. The floor of each septic tank compartment slopes toward a small sludge sump at the outlet end. These sumps are connected to an eight-inch drain leading to a ten by thirty-foot sludge bed just beyond the sprinkling filters.

After the plant had been put in operation, careful watch was

MONTEFIORE HOME

BEDFORD

SETTLING TANK
AND
SPRINKLING FILTERS



LONGITUDINAL SECTION

kept on its operation and it was found that the siphons were working only indifferently well, showing a decided tendency to dribble at the end of the discharge period. Changes were accordingly made which have resulted in positive action satisfactory in all ways.

The first change was the installation of float gates in the siphon chambers to render the operation of the siphons positive in their action. The quantity of sewage required to fill the chamber up to the level of the float is comparatively small and it is, therefore, not long before the float begins to rise, thus lifting the gate and permitting the stored sewage to pour rapidly into the chamber and start the siphon. As the sewage is discharged onto the filters the level in the chamber accordingly drops, the float thereby shutting off the further feeding of the siphon chamber and insuring a positive break in the siphonic action.

The second change was made to decrease the capacity of the siphon chambers, and cause a more frequent discharge of the siphons.

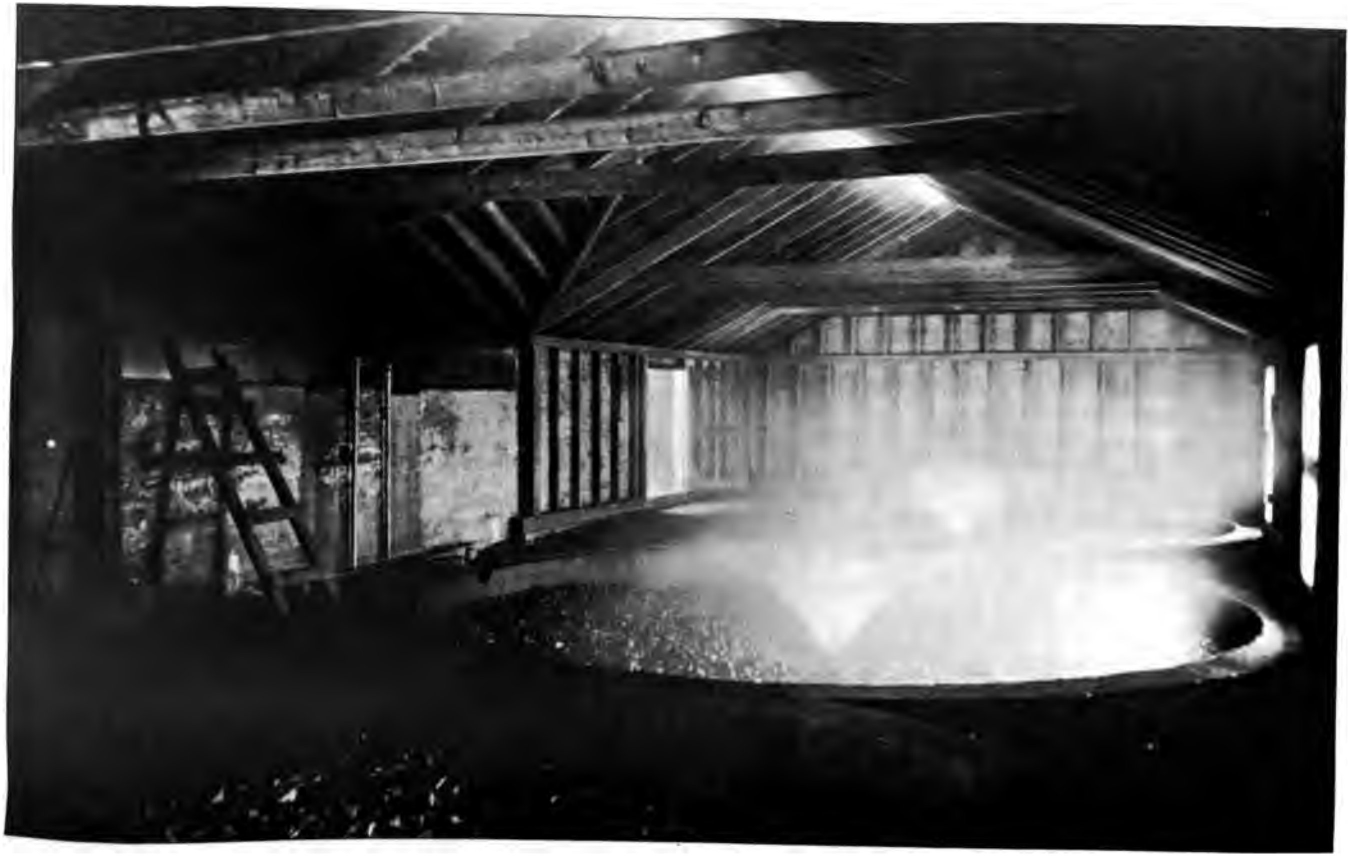
The discharge pipes of the two siphons are connected just beyond the end wall of the septic tank to a six-inch header pipe from which a four-inch wrought iron distributing pipe leads to each of the three filters as shown on the drawings, suitable gate valves being provided for regulating or cutting off the flow in the various pipes. The three filter tanks are contiguous and are symetrically arranged as regards the longitudinal axis of the septic tank with their centers on a line perpendicular to this axis. The septic tank and filters are all inclosed under a light frame structure with shingle roof, the main part of the building over the filters having a monitor and with adjustable shutters for ventilation.

Each filter is a cylindrical concrete tank nineteen feet six inches in diameter and about six feet three inches deep, measured from the top of the filtering material at elevation 406.5 to the floor of the tank. The filtering material is crushed stone ranging in size from one inch to two and one-half inches. The distribution of sewage over each filter is effected by a sprinkler nozzle placed just above the top of the filtering material at the center of the tank. These nozzles are of the type used at the Columbus, Ohio, sewage disposal plant.

A twelve-inch effluent pipe leads from the outlet end of the main underdrain of each filter to a connection with a twelve-inch header pipe just outside the building, from which in turn a twelve-inch pipe carries the effluent to the settling basin. This basin is twelve feet square on the bottom and all its sides slope outward at an angle of about forty-five degrees. The depth of water in the basin is about two and one-half feet, and its capacity is about 600 cubic feet. It is intended to collect any solid particles that may be in the filter effluent and is provided with an eight-inch vitrified drain through which such particles may be removed to the sludge bed. A concrete weir wall extends clear across the outlet end of the basin and over this the effluent flows to an eight-inch vitrified drain leading to the trenches. A six-inch bypass pipe is provided so that the settling basin can be cut out when cleaning or repairs are necessary.

The open trenches occupy a sidehill area of about 300 x 500 feet, the longer dimension being measured along the sidehill. The slope of the hill is fairly uniform, the fall being in general about five feet in forty feet. There are about ten parallel ditches, the top one being nearly coincident with the contour 395 and the bottom one being just above contour 365. The trenches are about eighteen inches deep and about one foot wide on the bottom with flaring sides. Below the lowest trench is a catch-drain trench, with its top about at elevation 360. This trench is three feet deep with flaring sides, and is filled with crushed stone or gravel. Its bottom and downhill side are lined with a three-inch slab of concrete, and along the bottom of the trench on the concrete is laid a six-inch vitrified pipe drain with open joints, having a fall of one foot in 100 feet. An open gutter extends along the top of the slope above the trenches to carry off surface water which would otherwise run down into the trenches.

The plant was designed by Messrs. Hering & Fuller, Consulting Engineers, of New York.



Bedford, Montefiore Home. Sprinkling Filters.

BREWSTER

Brewster is located near the extreme eastern end of the State at the foot of hills about 800 feet high. The population is about 1,300.

The water supply is obtained largely from the property of a Mr. Yates, situated on the hillside, the remainder coming from wells in the lowlands owned by private individuals. Recently the village purchased the system of Mr. Yates for $15,000 and it has voted an additional $50,000 to be spent on the system in enlarging the storage reservoir and in laying new and larger pipes to replace those which have been in use for nearly forty years. At present a two-inch pipe leads the water from the reservoir to the village, where it is distributed through about six miles of pipe. In the improved plant eight-inch, six-inch and four-inch pipe is to be laid. When completed the reservoir will impound enough so that the village will be supplied for nine months of the year independently of any other supply. The present reservoir is thirty feet in diameter, twenty-five feet deep and supplies water to a population of 450. A well owned by Mr. Avery furnishes water to about 100 people for the entire year. Sixty-five connections have been made to the system, but no meters are in use, and the daily consumption, which is estimated at 50,000 gallons or about 111 gallons per head per day, is not definitely known. This water is supplied at a head varying from 49 feet to 160 feet.

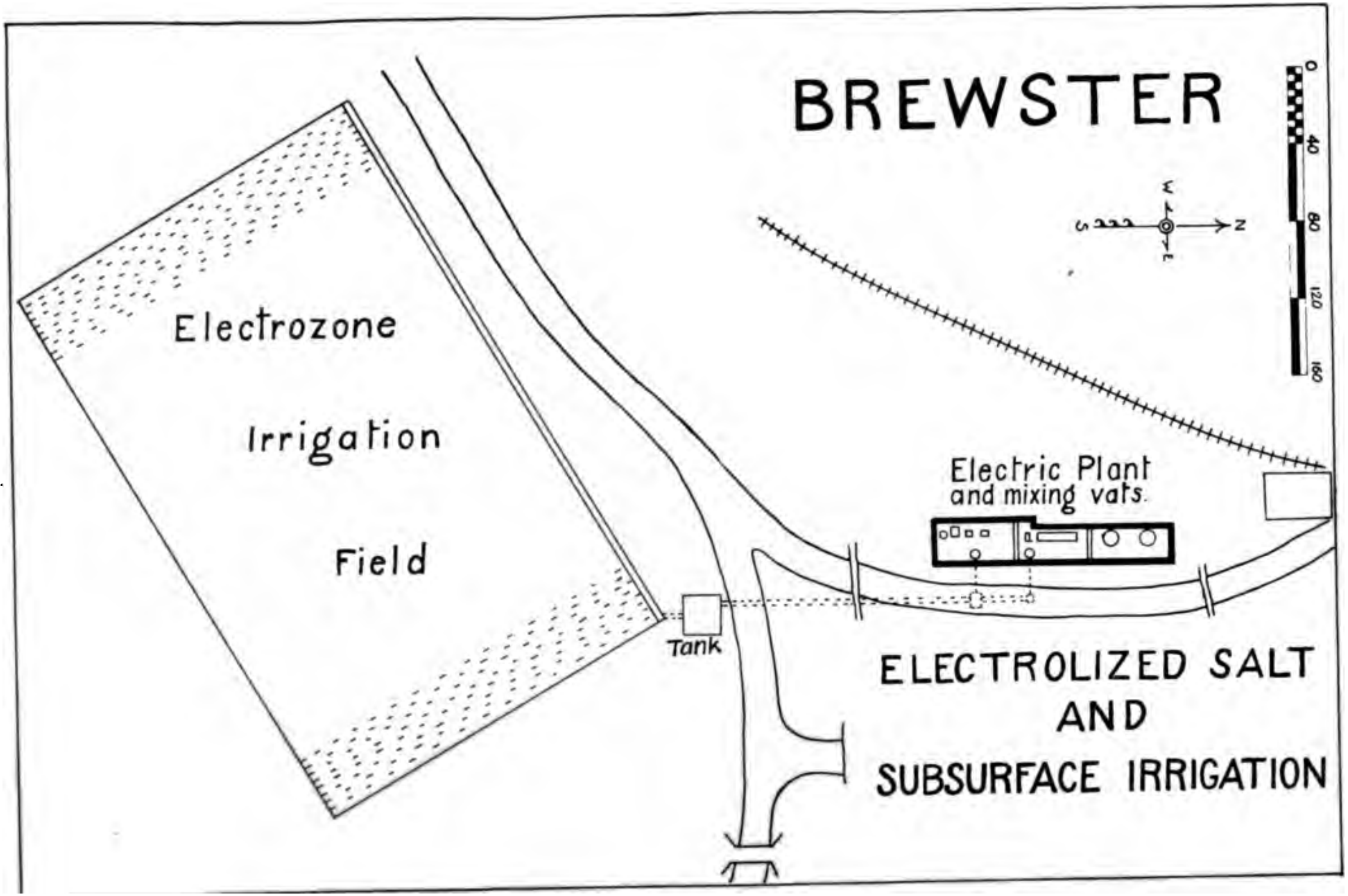
The sewerage system and purification plant were installed in 1893, the purification plant being built by the Wolff Disinfecting Company and thoroughly tested by them before being turned over to the authorities of New York city. The system of pipes collecting the sewage has a length of about six miles, to which seventy-five connections have been made, and through these connections the sewage of 500 people is carried to the purification plant. During treatment the sewage passes through three chambers and, roughly, 250 feet of pipe into an open channel, from which it passes, at right angles, through inverted horseshoe tile into the surrounding soil into what is termed the "Electrozone Field." There are no flush tanks in the system, grades rendering these unnecessary.

As the sewage enters the chamber, in which it is mixed with the disinfectant, it is somewhat stronger than the average sewage, as it receives but little ground water and is flushed only by water entering the bowls and toilets. As the sewage leaves the open channel extending along the 360 feet of length of the "Electrozone Field" it is markedly turbid, having a dirty white color and containing considerable sedimentary matter. Two samples of the effluent taken from this open channel showed putrescibility in fifteen hours. Approximately 17,000 gallons are treated daily.

The treatment for purification at this plant is quite different from that at any other plant in the State. To effect purification the sewage is mixed with a salt solution through which has been passed an electric current. Into a vat holding 1,500 gallons of water is placed about 300 pounds of salt. An electric current of 500 amperes at five volts is sent through the tank for six hours ordinarily or until the solution has a density of two Baumé.

Two tanks are used to prepare the solution and at night one of these is so arranged that the 1,500 gallons of solution slowly feeds into the sewage. The electric current is generated by steam power, the boiler being housed in the building with the two vats. One generator furnishes the current, but a second, which was originally used, is available in case of an emergency, as is also the old boiler which was used to run the second generator.

From the vats the purifying solution flows into two cisterns, mixing with the sewage as best it may as it flows through the cistern, there being no mechanical device for assisting in the mixing. Then, flowing through about 200 feet of pipe, a third cistern and about fifty feet more of pipe the sewage finally enters an open channel about 2 feet wide, 18 inches deep and 375 feet long. This channel extends along the longest side of the "Electrozone Field" and from it, at right angles, extend some sixty trenches of horseshoe tile laid three feet below the surface of the soil. The sewage is allowed to run through one of the trenches of seven-inch horseshoe tile until more refuses to flow, when the flow is diverted to a second row of tile. In this manner the flow is rotated from one trench to another until it becomes necessary to clean them. In cleaning the horseshoe tile seven men are em-


BREWSTER
0
40
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S
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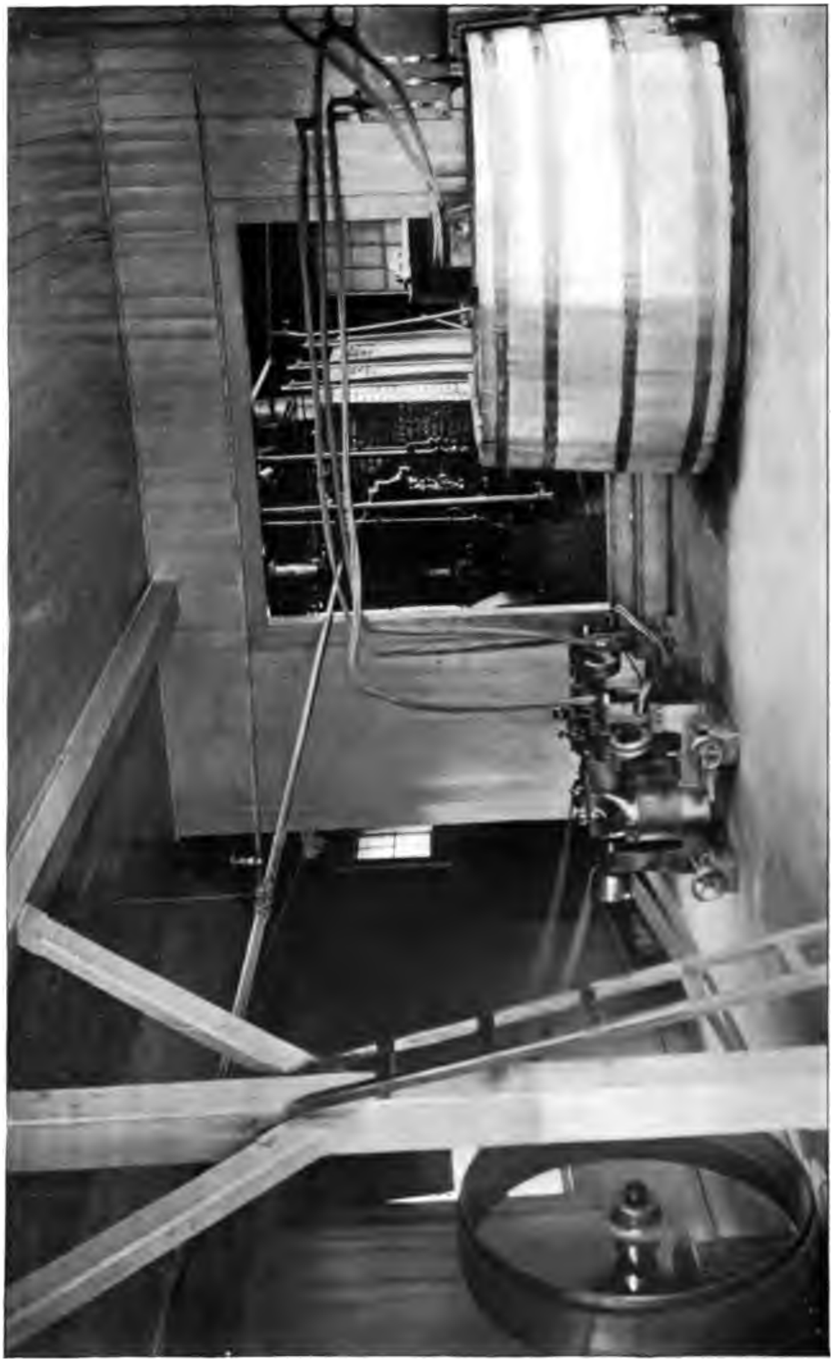
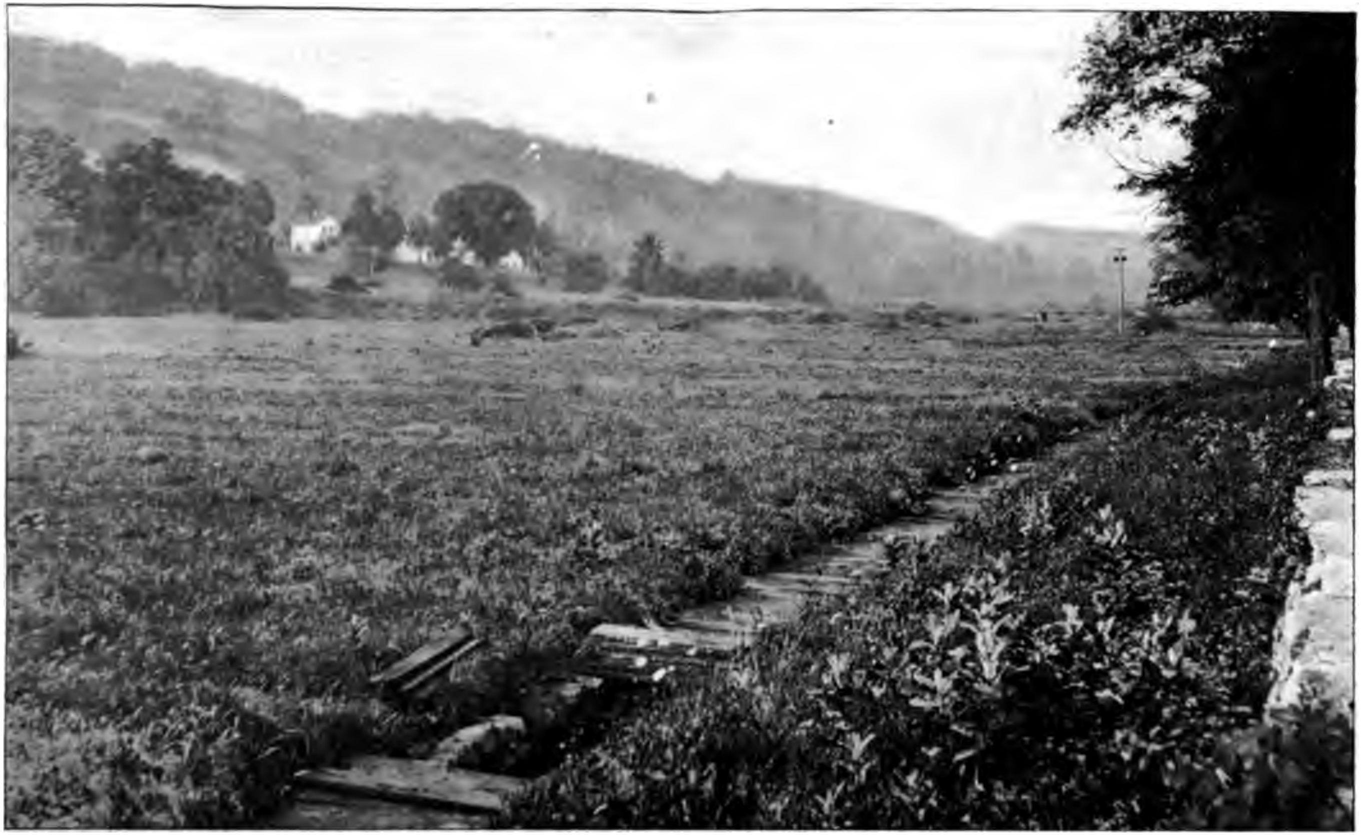
E
Electric Plant
and mixing vats.
Tank
Electrozone
Irrigation
Field
ELECTROLIZED SALT
AND
SUBSURFACE IRRIGATION





Brewster. View of " Electrozone Field " Extending to White Spot Under Tree at the Right.

View Looking Toward "Electrozone Field."

loyed for a week and the cleaning is done once a year. The solid natter accumulates to a depth of about one and one-half inches n the tile trenches and when removed is buried near the "Elecrozone Field."

Annual cost of operation:

00 tons of coal, at $6.50 per ton	$650 00
00 sacks of salt, at 85 cents per bag	680 00
Engineer at plant, 365 days, at $3 per day	1,095 00
5 days labor, cleaning "Electrozone Field," at $2	90 00
Total	$2,515 00

The illustrations show, first, the building in which are housed he electric generators and the mixing vats. The second shows a ortion of the interior and the third shows a near view of the "Electrozone Field" and the open channel from which the drain tile are led off.

References: Engineering News, July 13, 1893, p. 41; April 3, 1892; Electrical Engineering of New York, July 19, 1893, pp. 53 and 54.

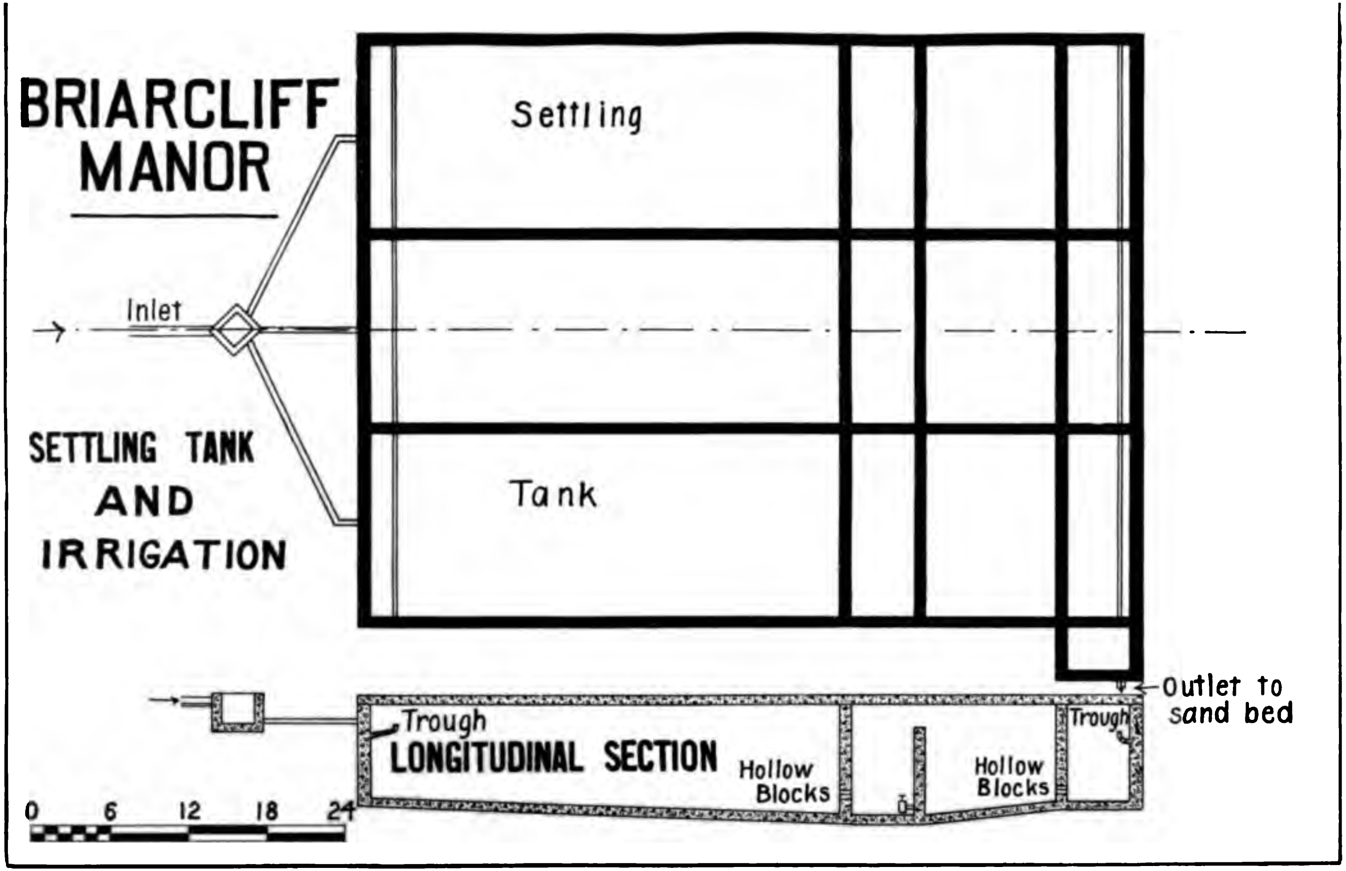
BRIARCLIFF MANOR

Briarcliff Manor is situated about three miles east of the east bank of the Hudson in the heart of a dairy district and has a population of 900.

The water supply is taken from sixteen wells that are twenty-three feet deep and from one well that is 250 feet deep. The water is pumped from the wells into the force mains forming the distributing system and that pumped in excess of the demand runs into a standpipe having a capacity of 100,000 gallons. The total length of the water system is nine to ten miles, of which one-third is four-inch pipe. About 100,000 gallons are used daily and the supply is ample except for about six weeks during the summer. The system was installed in 1897 and has been added to since that time. There have been made to the system ninety-five connections.

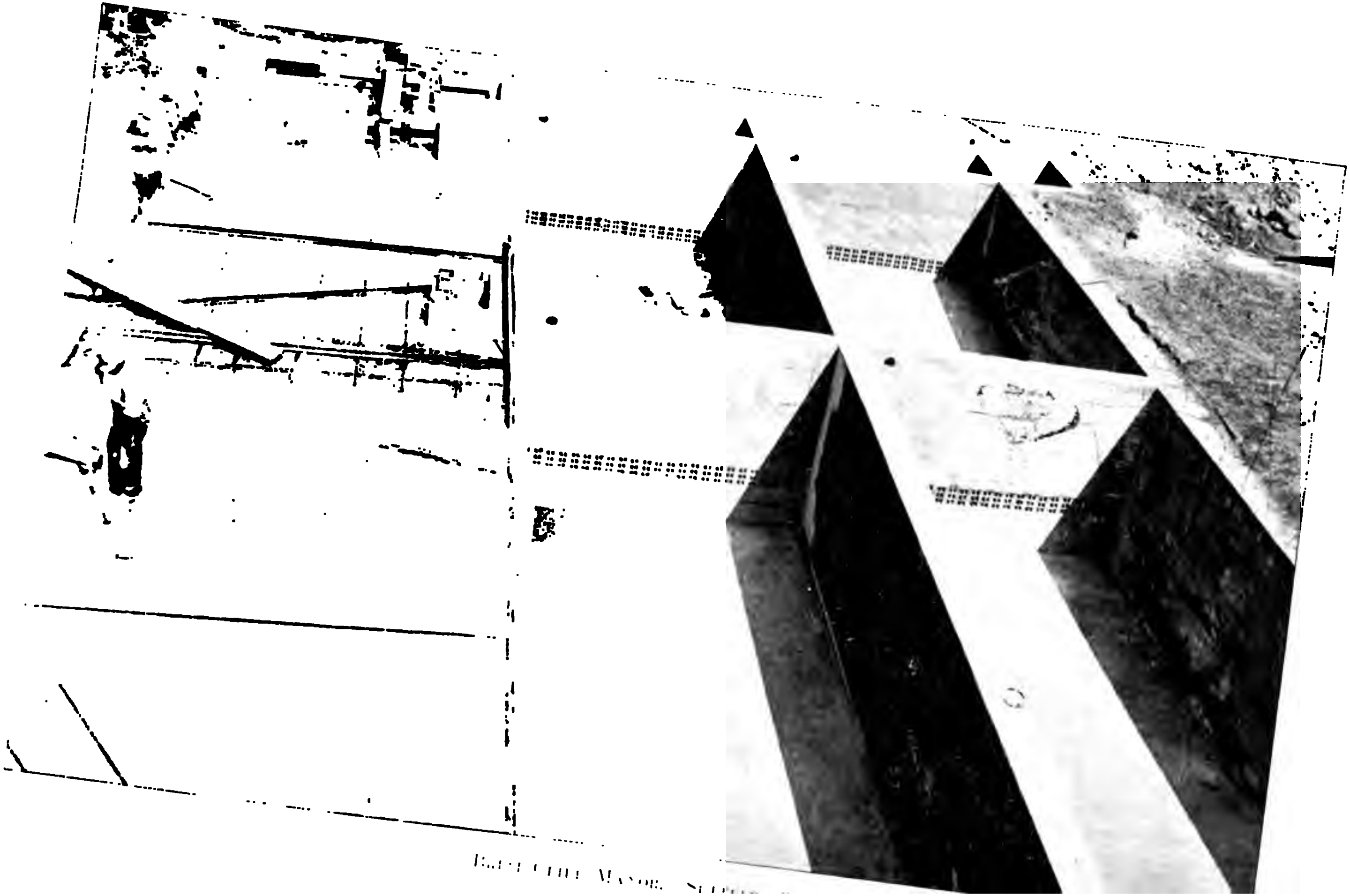
The sewerage system is not underdrained and contains six and one-half miles of cast iron and vitrified tile pipe, which forms the collecting system, two settling tanks, now building (August 3, 1907), a well fifteen feet in diameter and fifteen feet deep, from which the tank effluent is pumped through 3,500 feet of four-inch wrought iron pipe, and a sand pit of five and one-half acres area, upon which the effluent is pumped and from which it filters into the surrounding soil. A separate storm system, having a length of two miles, cares for most of the storm water. The sewerage system was built two years ago and about 100 connections have been made to it since that time. One hotel and three schools have been connected, but the remainder of the buildings connected are residences.

The sewage is domestic and receives only a small amount of ground water and storm water. The flow is between 75 and 100 gallons per head per day. Just before the sewage enters the settling tank it enters a chamber four feet square and four feet deep, from which there are three ten-inch pipes leading to the three divisions of the tanks, one of the tanks having a series of two divisions and the other having three divisions. From the first chamber, which only affords an opportunity for diverting the flow from one division to another, the sewage passes through about fifteen feet of ten-inch pipe and enters a concrete trough eighteen inches wide, four inches deep and two feet from the top and on the inside of the chamber. Each division of the tank is divided into four compartments. From the concrete trough which the sewage enters at first, it falls into the first compartment of the division, this compartment being thirteen feet wide, thirty-six feet long, ten feet deep at the intake end and twelve feet deep at the discharging end. At the discharging end of this chamber the wall has a layer of terra cotta one foot thick and placed two feet from the bottom of the chamber, through which the sewage flows to a second chamber about three feet wide and thirteen feet long. The sewage has a depth of seven to nine feet in the first chamber, this depth being governed by the location of a six-inch pipe and valve leading from the second chamber to the

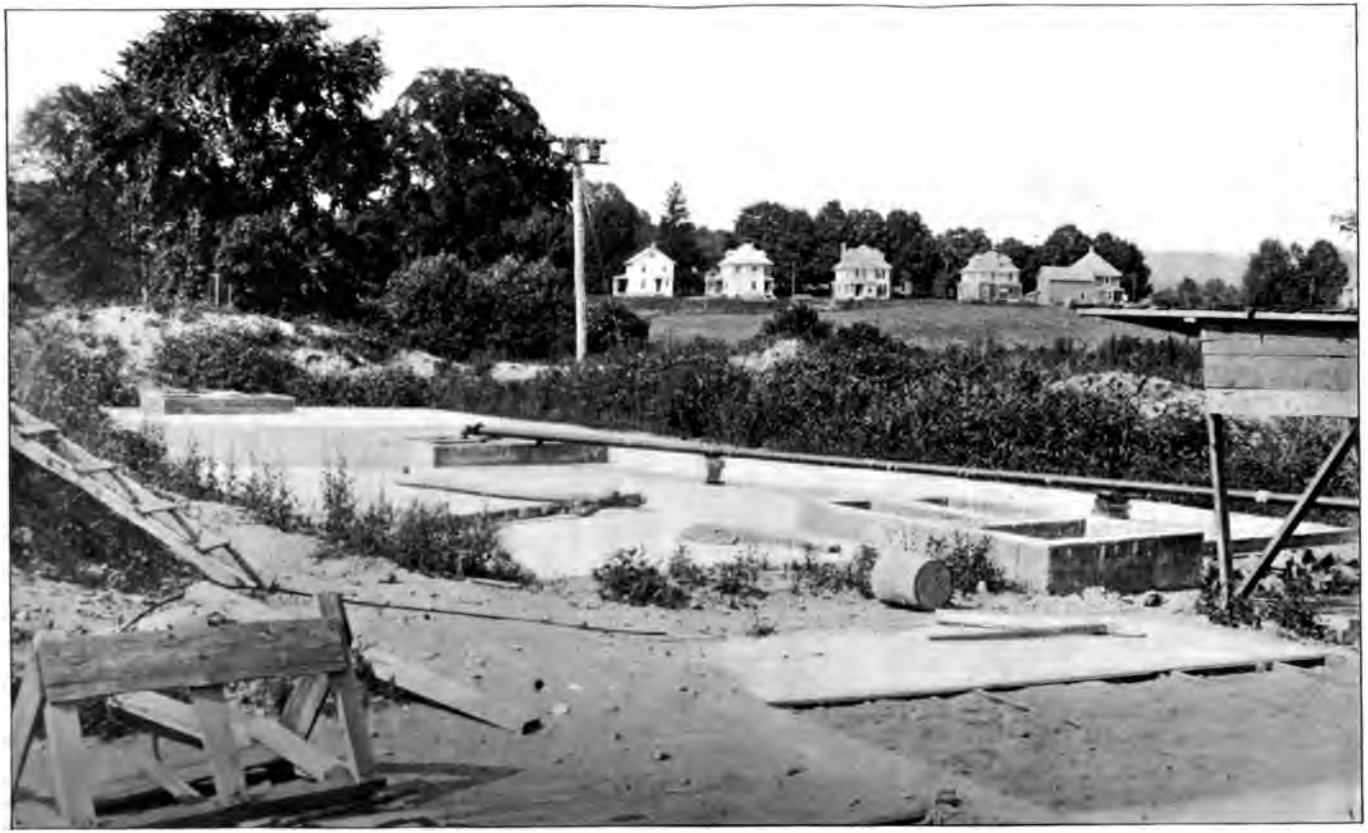


BRIARCLIFF MANOR

SETTLING TANK AND IRRIGATION



East Cliff Manor,



Briar-Cliff Manor. Covered Settling Tank with Two Sets of Chambers.

hird chamber. This third chamber is thirteen feet long, about en feet wide and at its outlet end has a layer of terra cotta locks one foot thick and placed four inches above the chamber ottom. From the third chamber it passes through this layer of rra cotta blocks into the fourth and last chamber of the division. his chamber is four feet wide and along its thirteen-foot exterior ide is placed a nine-inch concrete channel into which the sewage ows and by which it is conveyed to a small effluent well adjaent to the tank. From this well the effluent flows by gravity to he well, from which it is pumped upon the filtration area. The ettling tanks are made of reinforced concrete and are covered with a flat roof of the same material.

The settling tanks are to be cleaned by lifting the solid matter from them by hand. The smaller of the two chambers is built exactly like the larger one except that it is but two-thirds of the size of the larger. The smaller plant is distant about one mile from the larger plant and the filtering area is distant about .75 of a mile from the smaller plant and 1.75 miles from the larger plant. The tank effluent from both tanks is discharged into the well near the smaller tank and pumped from that point to the filtration area distant .75 of a mile.

As one of the chambers was not in use and as the other could scarcely be said to be in operation no test for putrescibility was made.

The total cost of the sewerage system will be between $5,000 and $6,000.

The illustrations show the tanks both uncovered and covered. The pervious terra cotta blocks are plainly to be seen.

BROCKPORT

Brockport is located about seventeen miles west of Rochester and its drainage reaches Lake Ontario, distant about ten miles, through Salmon creek.

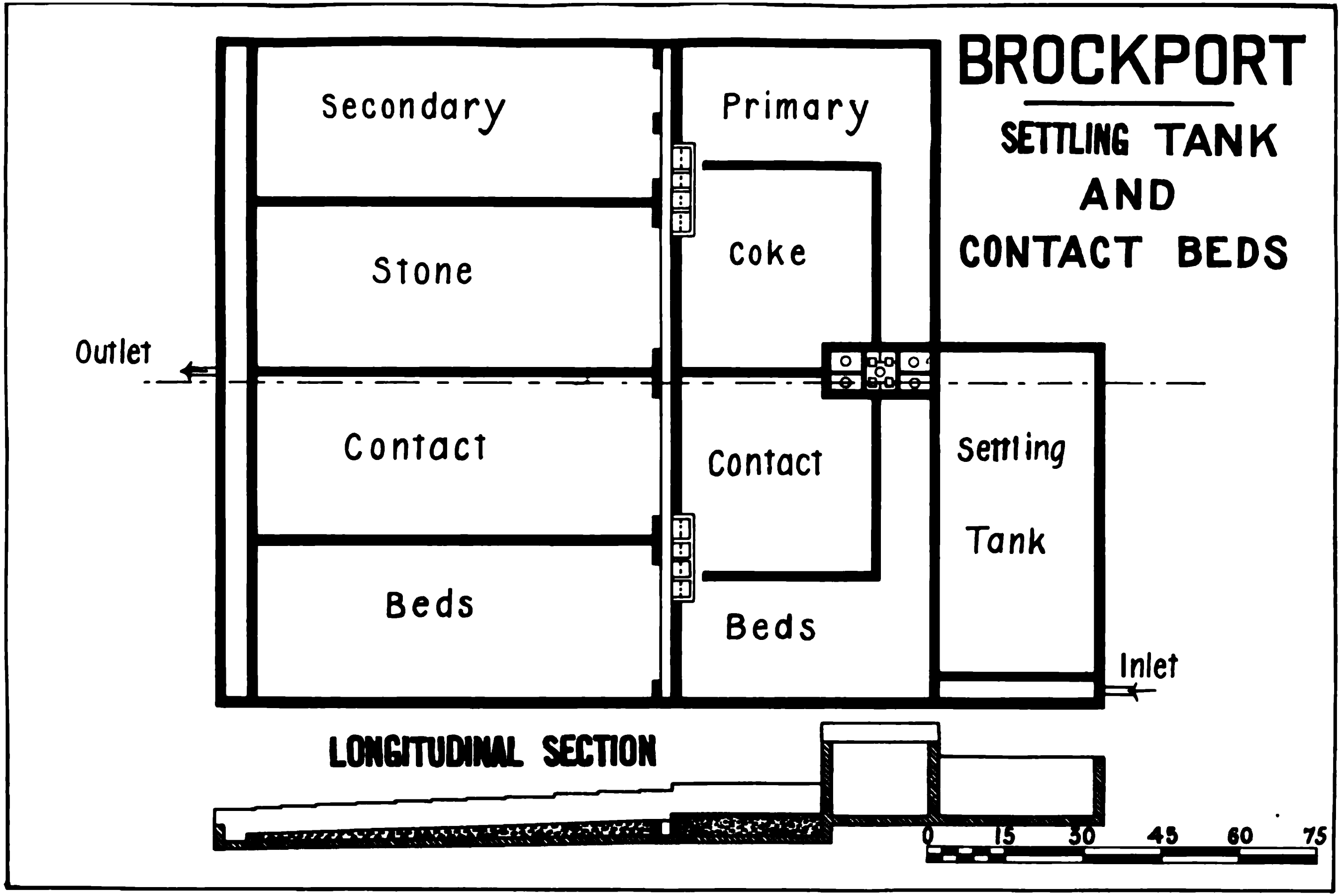
The water used in the village is purchased of a private company which also supplies the village of Holley. It is taken from six wells near Holley, one of these wells being 100 feet long, 9 feet wide, and 10 feet deep, the others having a diameter of twenty-four feet and a depth of nineteen to twenty feet. From these wells the water is pumped into two tanks of a capacity of 275,000 gallons each. One of these tanks is stationed at Holley and the other at Brockport, four miles distant, but the two are connected and stand at practically the same level at all times. The village of Brockport is situated near the top of a divide from which the drainage flows south, west and north, and it is difficult to obtain as much water as is desired. To meet this demand new sources of supply are now being studied. About seven miles of water pipe have been laid to and in the village, to which 800 connections have been made. No figures on the total daily supply of water were available, but it is approximately 200,000 gallons, 15,000 gallons of which are used to flush the sewers.

The sewage system and purification plant were completed a put into operation in November, 1904. The system compris some seven and one-half miles of pipe, to which 366 connectio have been made; fifty-two flush tanks, each having a capacity 365 gallons, and the purification plant. Though fifty-two flu tanks were built, but forty-one are being operated. Of the 3 connections that have been made to the system, there are, besi residences, five manufacturing establishments, but the sewage wholly a domestic one. While the sewer system is not und drained water is not abundant, and little or no ground-wa enters the system. Purification of the sewage is effected by s imentation and by contact beds.

The sewage first enters a grit chamber twenty-eight feet lo two feet wide and ten feet deep. At a distance of about th feet from the top of the main tank the sewage flows from the g chamber into this main chamber, which is sixty-five feet l and twenty-eight feet wide. This chamber has not been clea in four years and at the present time the sediment has accu lated to a depth of eighteen inches. At the outlet end of chamber and about two and one-half feet from the bottom of chamber is a square pine box two feet square, and having its si perforated with two-inch holes. It is through this box that sewage flows into the receiving basin.

BROCKPORT

SETTLING TANK AND CONTACT BEDS



In this receiving chamber are four automatic siphons so arranged that when the sewage has reached a given depth in one contact bed the flow is automatically changed to a second bed. There are four of these primary beds filled with coke to a depth of four feet, the bottom two feet being broken to pass a two-inch ring. Over this coke has been placed a six-inch layer of crushed stone to prevent the disappearance of the coke. At the lower end of these beds are placed automatic siphons which discharge the sewage into a second set of beds. The sewage empties from the first bed into an open channel running across the head of the second bed and from this channel it filters through a wall of rip rap stone into the crushed stone. This crushed stone at the head of the second bed is about twenty-four inches deep, at the lower end about twelve inches deep, and is about the size of stove coal. The sewage flows along the bottom of this bed discharging at the lower end along the entire width of the bed into a concrete channel which carries the effluent to the discharge pipe.

From this pipe of entry it flows through about thirty feet of pipe into a small unnamed stream. The flow of the stream is so small that a four-inch siphon is being used (July, 1907), to draw water from the Erie canal to augment it.

The effluent is colorless, without odor, and samples of the sewage taken after passing through the first and after passing through the second bed showed no indications of putrescibility in seven and one-half days.

As running at the present time, July 10, 1907, the sewage flows into the beds for sixty minutes, stands for forty-two minutes and is about thirty minutes in emptying, most of the sewage passing from the bed in twenty-two minutes.

About six months ago something like fifty square feet of the roof of the main tank over the perforated box outlet fell into the tank and this has not yet been removed. There is considerable solid matter on the contact beds at the point of receiving sewage and it may be that the falling of the roof has damaged the perforated box, or has brought the surface of the sediment in the chamber near the box.

The plant is visited two or three times daily to see that it is operating perfectly.

Three beds are used constantly, the fourth being given a rest of two weeks before being used. The beds are cleaned every two weeks and usually require the time of two men for a half day at each cleaning. The material taken from the beds is used as fertilizer, the coke taken up with it being piled near the tank. About six tons of coke at $5.85 per ton plus haulage of one and one-fourth miles are required annually to replace that taken from the beds. The grit chamber has been cleaned twice in the four years, one-half day being required to clean the same. The solid matter taken from the grit chamber serves well as a fertilizer, its effect being shown on the crop near the tank. The growth where the sludge was spread had a much deeper color, and was more luxuriant.

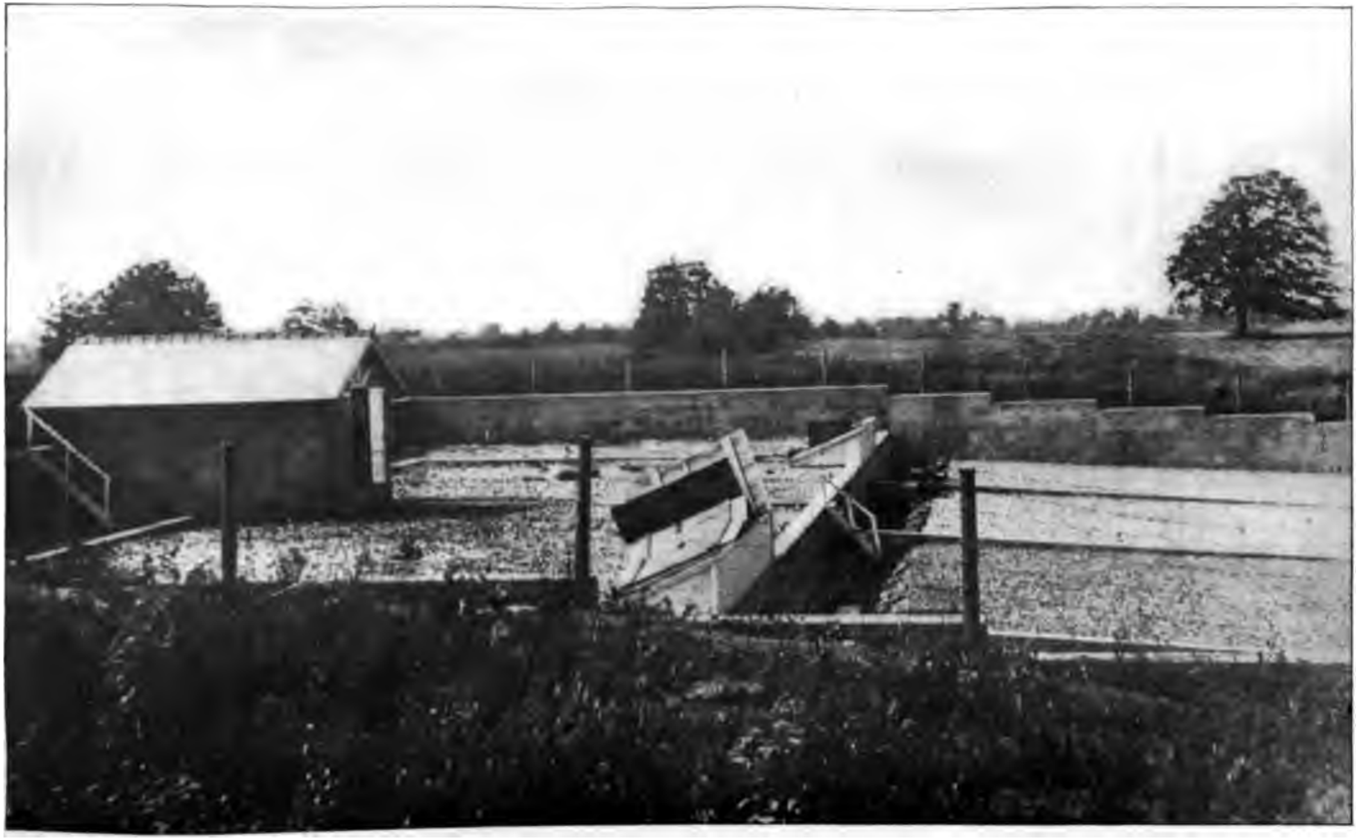
The disposal plant was designed by Knight & Hopkins of Rome, N. Y., though modified in construction. A Buffalo contracting firm guaranteed the tank roof for ten years and will be asked to repair the same.

The illustration shows the contact beds, the small building on the left being the shelter for the automatic siphons which control the flow onto the primary beds.

Chemical analysis of the sewage of Brockport and of the effluent from the disposal plant. The samples were taken January 16, 1905, and the results are given in parts per 100,000.

Appearance.	Sewage.	Effluent.
Color	Greenish-yellow tint.	Greenish tint.
Turbidity	Slight.	None.
Sediment	Brownish.	None.
Flocculent	Yes.	
Odor	Slight.	Very slight.
Chlorine	3.90	3.70
Free ammonia	0.4680	0.0740
Albuminoid ammonia	0.0360	0.0220
Nitrogen as nitrites	0.1110	0.0380
Nitrogen as nitrates	0.3920	0.4360
Total solids	52.20	51.20
Loss on ignition	14.40	15.80
Behavior during ignition	Blackened slight odor.	Darkened slightly.
Mineral matter	37.80	35.40
Oxygen consumed	0.7865	0.4115

Purification by albuminoid ammonia	39%
Purification by oxygen consumed	47%



Brockport. Disposal Plant.

BRONXVILLE

Bronxville is situated in the southern part of Westchester county on the Bronx river. Its population is 1,200.

The water used by the village is supplied by the New Rochelle Water Company. The water supplied by this company, according to a map published by them, is taken from two reservoirs and wells. Reservoir No. 1 is 3.75 miles from the New Rochelle town hall, covers an area of 60.5 acres, has a perimeter of about 2.25 miles and a storage capacity of 271,735,700 gallons. Reservoir No. 2 is about 2.333 miles from the New Rochelle town hall and perhaps two miles from Bronxville. It covers an area of 18.2 acres, and has a capacity of 47,268,000 gallons. At the lower end of this reservoir there is located a standpipe 140 feet high and having a capacity of 500,000 gallons. There is also at this point an artesian well 1,150 feet deep and having a pumping capacity of 17,000 gallons in twenty-four hours. Three pumps at this place have a daily capacity of 3,500,000 gallons. Eighteen six-inch wells fifty-five feet deep and located only a short distance from the artesian wells and the lower end of reservoir No. 2 supply, if needed, 1,000,000 gallons daily. Statistics for Bronxville alone are not available, but in Bronxville, Tuckahoe and the outlying districts 486 connections have been made to about 22.6 miles of pipe laid since 1894. The annual consumption of water for these places is 31,250,000 gallons of 85,616 gallons daily, not including water used for fire purposes. The population supplied must be near 2,000, which gives a daily per capita consumption of forty-two gallons, a rather low value.

A standpipe at Tuckahoe receives the water that is not consumed while the pumps are in operation.

The sewerage system contains 30,000 feet of pipe, two flush tanks of a capacity of 365 gallons flushed once in twenty-four hours, an electrically driven pump to pump the sewage and a settling tank. To this system 154 connections have been made including Algea Court, the Gramatan hotel, the Arcade, five stores and three apartments. The sewers are flushed weekly. The 1,600 feet of pipe on the low level are underdrained.

The sewage entering the system is domestic but it is diluted with water emptied from the manhole pans after each storm and what ground water may enter the system. The total population is connected to the system. Samples of the effluent taken from the point where the effluent enters the Bronx river were slightly turbid, and contained flocculent masses in suspension. The samples showed a loss of methylene color in sixteen hours.

The sewage before reaching the tank enters a well twelve feet square and fifteen feet deep, from which it is pumped into the settling chambers by one of two electrically driven pumps. From the pumps it enters a grit chamber twelve feet wide, twenty feet long and ten feet deep. Across this chamber is placed a vertical screen four feet high and having vertical one-half-inch rods spaced one inch center to center. From the grit chamber the sewage enters the settling chamber through four ten-inch bends. An eight-inch wall causes the sewage to flow nearly eighty feet before it passes from the chamber through two ten-inch bends into the dosing chamber. From this chamber it discharges through 250 feet to 300 feet of ten-inch pipe into the Bronx river.

A six-inch pipe entering the bottom of the two chambers enables the sludge to be deposited upon the low land surrounding the chamber and at a distance of fifty feet from the same.

Cost of labor annually:

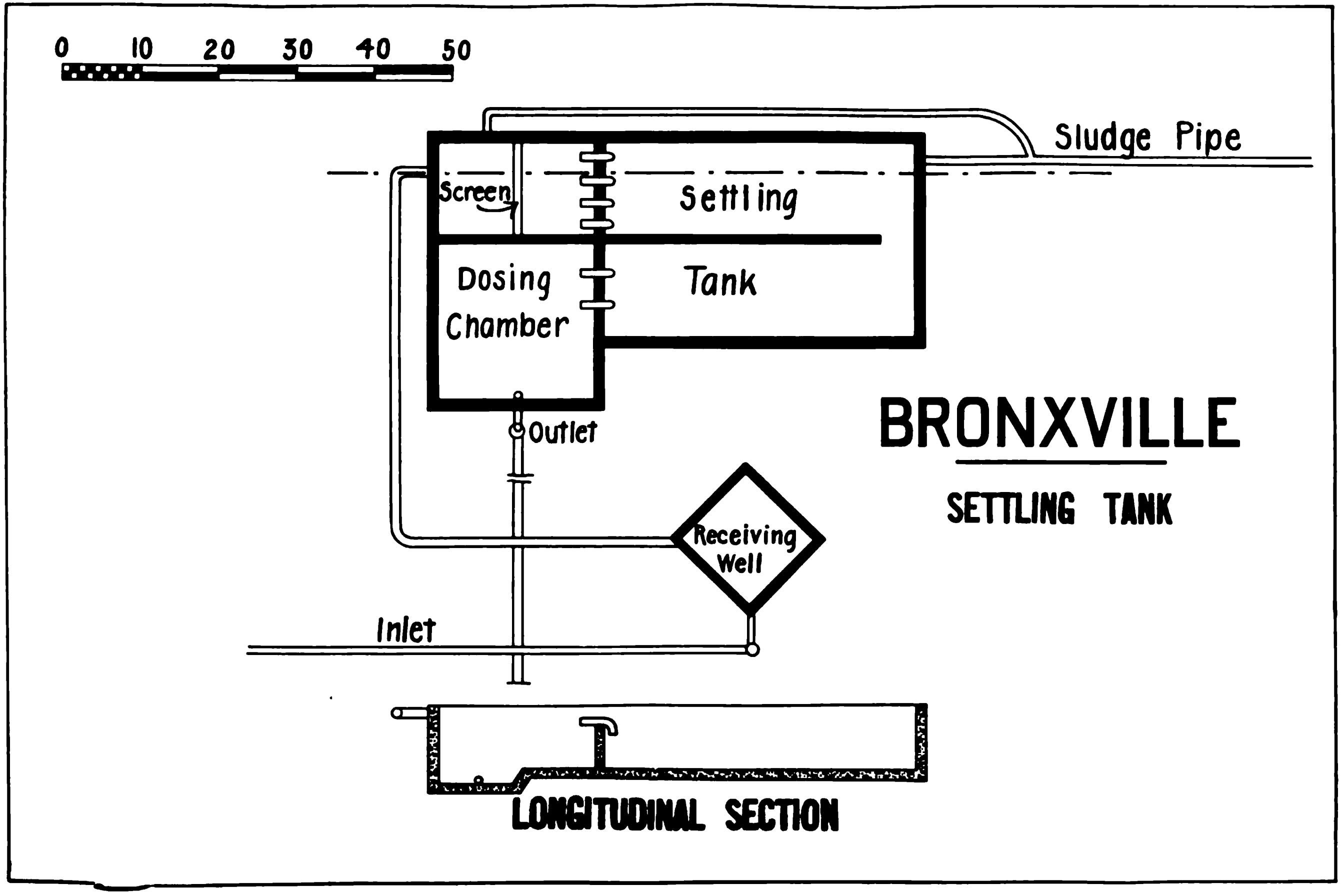
To keep manhole pans emptied and clean...........	$150 00
Engineer to watch pumps........................	180 00

The illustration shows the small brick building over the receiving well and in which are housed the electric pumps.

CENTRAL ISLIP

Manhattan State Hospital

The branch of the Manhattan State Hospital, located at Central Islip, Long Island, has a population of 4,500. The institution is built as two separate colonies, one called the north colony, the other the south colony. The north colony has a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10
20
30
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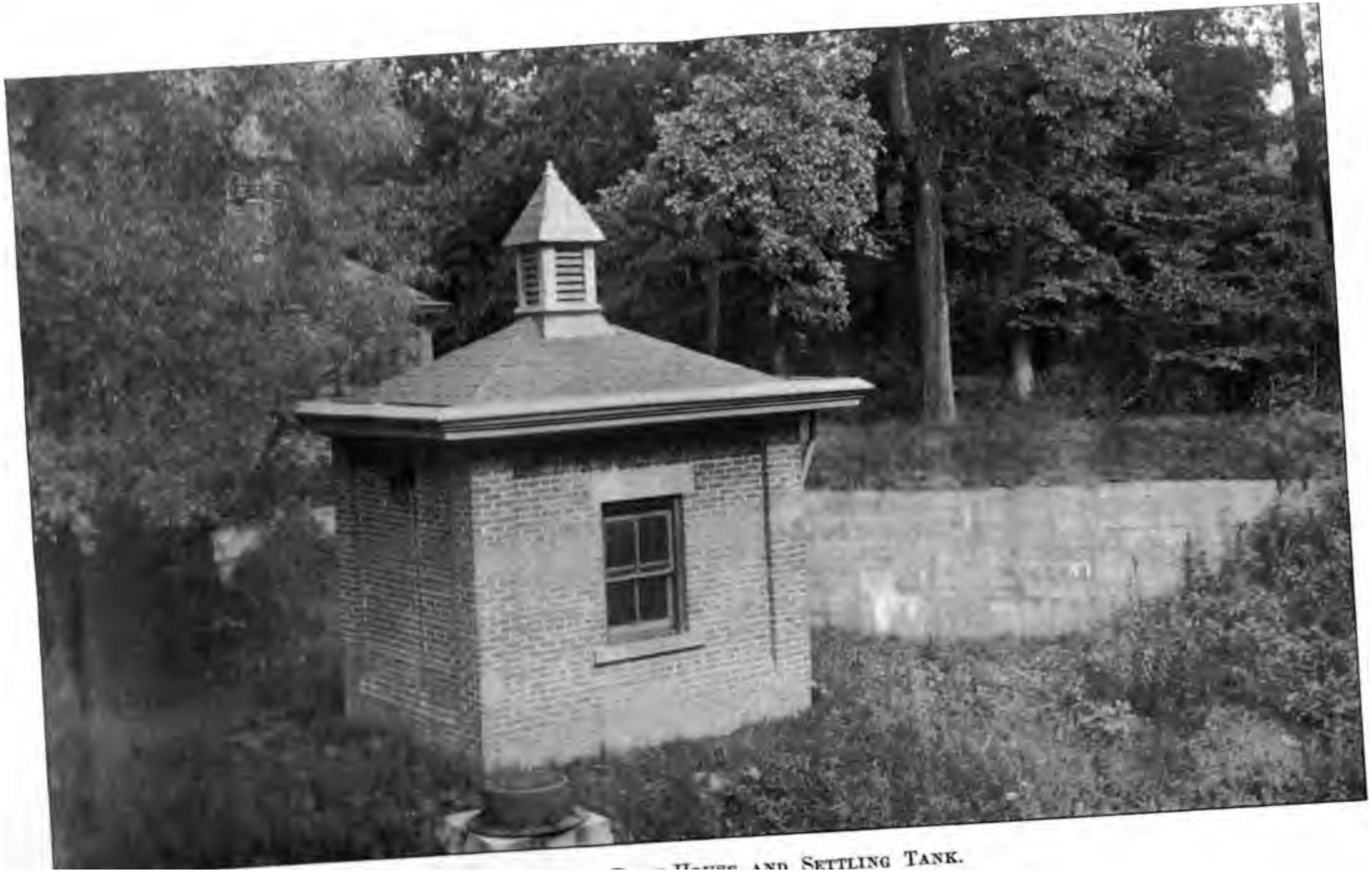
Sludge Pipe
Screen
Settling
Tank
Dosing
Chamber
Outlet
BRONXVILLE
SETTLING TANK
Receiving
Well
Inlet
LONGITUDINAL SECTION



House and Settling Tank.

population of 1,500, and the south colony has a population of 3,000.

The north colony receives its water supply from twenty-four two and one-half inch wells from fifty feet to sixty feet deep. The water from these wells is pumped into a nearby standpipe fifteen feet in diameter and having a height of seventy-five feet and a capacity of 99,400 gallons. The old system was installed in 1889 and the present one in 1906. The present system contains slightly more than three miles of distributing pipe and supplies water to forty buildings spread out over an area of 200 acres.

The south colony receives its supply from twenty-seven three and one-half inch wells, from which the water is pumped into a standpipe twenty feet in diameter, eighty feet high, having a capacity of 188,500 gallons and about fifty feet distant from the wells. In this colony there are twenty-seven buildings in one long row requiring one and one-half miles of distributing pipe. This plant was built in 1901.

The method of purifying the sewage of the two colonies is that of broad irrigation. At each colony a reservoir or well has been built and the sewage as it collects is pumped from these wells and forced into mains laid under 200 acres of the land belonging to the institution. A main pipe leads from the pump and at right angles to this and at intervals of 150 feet are laid the laterals through which the sewage is distributed over the area of irrigation. At intervals of from 150 feet to 200 feet hydrants are placed, extending two and one-half feet above ground through which the sewage is allowed to discharge. By means of valves the sewage may be discharged through any of the hydrants for any desired period of time. At present the period of discharge from a hydrant is one week. Neither collecting system is underdrained and no storm system has been laid.

The north colony system was laid in 1899, and has besides two reservoirs, one five feet long, three feet wide and twenty feet deep, and the other sixty feet long, thirty feet wide and nine feet deep, about two miles of vitrified pipe necessary to collect the sewage and about 6.25 miles of vitrified tile pipe necessary to distribute the same to the hydrants, of which there are

150. These tanks are cleaned annually and the solid matter carted away and used as fertilizer. The scum on the larger chamber was about six inches deep and there was little or no sediment in the chamber. From this well is daily pumped 150,000 gallons of sewage, an average of 100 gallons per head per day. Ten hours are required to do this pumping.

The south colony system has a distributing system of about 4,000 feet of cast iron mains with leaded joints, and five and one-half miles of vitrified tile with oakum and cement joints, a collecting system of about one and one-half miles in length, an uncovered concrete well seventy feet by ninety feet and about ten feet deep and the pumping plant. At the entrance to the well is placed a screen of one-half inch bars, spaced about one and one-half inches center to center which prevents any large particles from entering the well. This screen is cleaned daily. From this plant 300,000 gallons of sewage are pumped, an average of 100 gallons per head per day. Five hours are required to do the pumping.

The soil is sandy for a depth of about thirty feet and serves as a natural filter for the sewage discharged upon it. From 1889 to 1901 the sewage of the north colony was collected in a pond of less than an acre area. At this point the ground water is fifteen to twenty feet below the surface. Some idea of the efficiency of filtration may be obtained from the following statement taken from the annual report of the Managers of the Manhattan State Hospital: "Analyses of the ground water in the vicinity of this pond have shown that there was some contamination, but proof that such has never spread to the point where the water supply is taken is afforded by the fact that tests of water from driven wells thirty feet in depth made a few hundred feet from this pool have been found free from contamination.

The area over which the sewage is to be distributed is large enough to insure only about one foot in depth of sewage per year over the area."

North colony — Cost of digging and backfilling, $26.550; cost of steam consumed to operate pumps estimated at 5.5 per cen. of $3,000, or $165; wells cleaned by inmates; pumps cared for by an inmate.

Central Islip. South Plant.

Central Islip. North Plant.

South colony — Cost of entire plant, $45,000; cost of steam consumed estimated at 3 per cent. of $3,000, $90; well cleaned by inmates; pump cared for by an inmate.

The illustrations show the large receiving tank for the south plant and the roof of the tank and the general appearance of the fields at the north plant.

CHAUTAUQUA

The Chautauqua assembly grounds are situated at the head of Chautauqua lake in Western New York. The effort to maintain a summer school at this place has been successful and during the summer months the population ranges from 6,000 to 7,000, with an attendance as high as 12,000 on the occasion of a convention or the appearance of some prominent lecturer. To prevent the pollution of the waters of Chautauqua lake to the injury of cities and villages lying along its shores, and to prevent the possibility of such an insanitary condition of the water at the head of the lake as to become a nuisance to the assembly, it was decided in the fall of 1892 to build a chemical precipitation plant. This plant was contracted for in January, 1893, and work was begun in April of the same year.

At the present time, July, 1907, the water supply of the assembly is taken from four artesian wells, furnishing from 10,000 to 20,000 gallons daily; from private wells to an unknown extent; and from Chautauqua lake to the extent of 600,000 gallons daily. The water taken from the artesian wells rises to within about five feet of the surface of the earth and is pumped into an elevated tank sixteen feet in diameter and sixteen feet high. This water and the water taken from private wells is used for drinking and cooking purposes only. The water pumped from the lake enters an earthen reservoir, having a capacity of about 11,000,000 gallons, and is then distributed to be used for flushing closets, for bathroom purposes, for washing dishes and for general housework requiring the use of water. The entire population of the assembly is supplied with the water taken from the artesian wells and from the lake. About 6,000 feet of pipe are required to supply the residences with drinking water and about the same amount to supply the water taken from the lake. The system for conveying the drinking water was built in 1893.

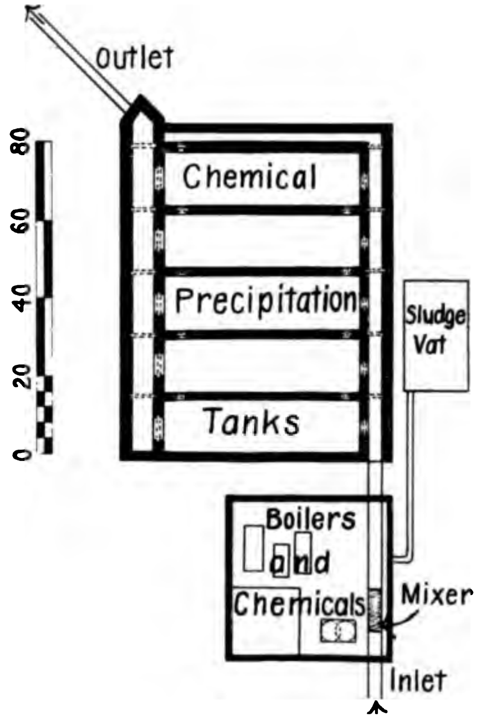
The sewerage system, built in the same year, comprises eleven miles of pipe necessary to carry the sewage to the chemical plant, the chemical precipitation plant and about 600 feet of pipe necessary to carry the effluent of the precipitation plant into the lake. There were flush tanks at the head of several laterals but they were not satisfactory in operation and at present the flushing of the sewers is accomplished by the use of a tank wagon having an eight-inch outlet and carrying from 600 to 700 gallons. This wagon is driven over any desired manhole and thus far has flushed the pipes in a very satisfactory manner. About 600 connections have been made to the sewer system, and it receives the sewage from all parts of the assembly with the exception of the Men's club. This is located on lower territory than the disposal plant and the sewage is discharged directly into the lake at a point about 1,300 feet distant and on the down stream side of the intake end of the pipe through which water is pumped for general housework.

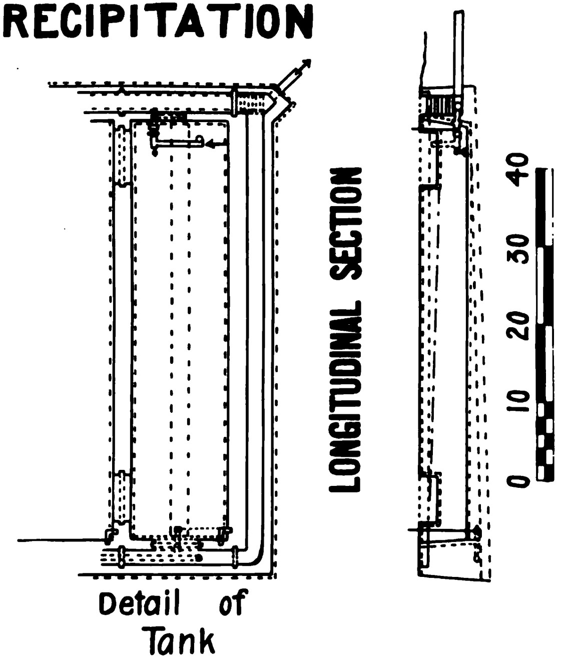
As at present treated, the sewage enters the chemical precipitation plant through a twenty inch pipe. After flowing through about ten feet of this pipe the milk of lime solution is introduced and the sewage and lime solutions are thoroughly mixed by passing through a horizontal and helical mixer very much resembling the bristled street sweeper. The sewage then passes on and from the building housing the engine, boiler, vats for the lime water, etc., into the five sedimentation tanks, which are uncovered, and which have a length of fifty-six feet, a width of twelve feet and a sewage depth of 4.5 feet. Originally there were four these tanks but since the plant was built it has been found necessary to add another tank. After flowing through these tanks the sewage passes over a series of steps and through a fifteen inch pipe extending into the lake.

The sludge, as described by Wm. B. Landreth in Transactions of the American Society of Civil Engineers for July, 1894,

CHATAUQUA

CHEMICAL PRECIPITATION





lects in the sludge well beneath the floor of the machine-
use. From here, however, it does not pass through the filter
ess as it originally did. Since 1902 the sludge, instead of
ssing through the filter press, has been pumped directly into
wooden vat about twenty feet wide, thirty-two feet long, six
et deep and located near the five sedimentation tanks. The
idge or solid matter remains here until removed to be used as
fertilizer or to be thrown upon a waste heap near the machine-
use while the liquid portion of the sludge returns to the tanks
be treated as any other sewage. Usually the sludge is re-
oved from all of the tanks at least annually, and from the
o tanks nearest the machine-house three and four times.

No chemical analysis of the sewage has been made since 1893
d the results of this analysis may be found in the Transactions
the American Society of Civil Engineers, July, 1894, or
igineering News, February 1, 1894.

About three years ago the screen was taken from the inlet
wage pipe allowing all solid matter to enter the tanks. The
e of chemicals other than lime has also been discontinued ex-
pt when the solid matter does not settle readily in the sedi-
ntation tanks when a small amount of alum is used to induce
limentation.

Cost of building the disposal plant was $17,000; cost of lay-
g sewers to disposal plant and from disposal plant to the lake
5,000.

Annual cost of operation (covering period of 2.5 months dur-
g the summer): 274 barrels lime, at $0.87, $238.38; 200
unds alum, at $0.02, $4; coal, .5 ton daily, about thirty-eight
is per season, at $4, $152; labor of engineer and assistant,
out $400; total $794.38.

The illustration shows the boiler-room and the precipitation
iks in the foreground.

References: Engineering Record, June 27, 1896, and June
, 1891, p. 86; Transactions of American Society of Civil
igineers, July, 1894; Engineering News, September 21,
93, pp. 239, 240, February 1, 1894; sewer design by H. N.
dden, pp. 115–118.

CONEY ISLAND

Disposal Plants in the Borough of Brooklyn and under Borough Control

Situated on the southern shore of Long Island and south of Brooklyn, in the borough of Brooklyn, is the well-known summer resort, Coney Island. On account of the abnormal population of the district transiently on some summer days and because of the desire that it shall be a popular summer resort the sewage is purified before being discharged into salt water.

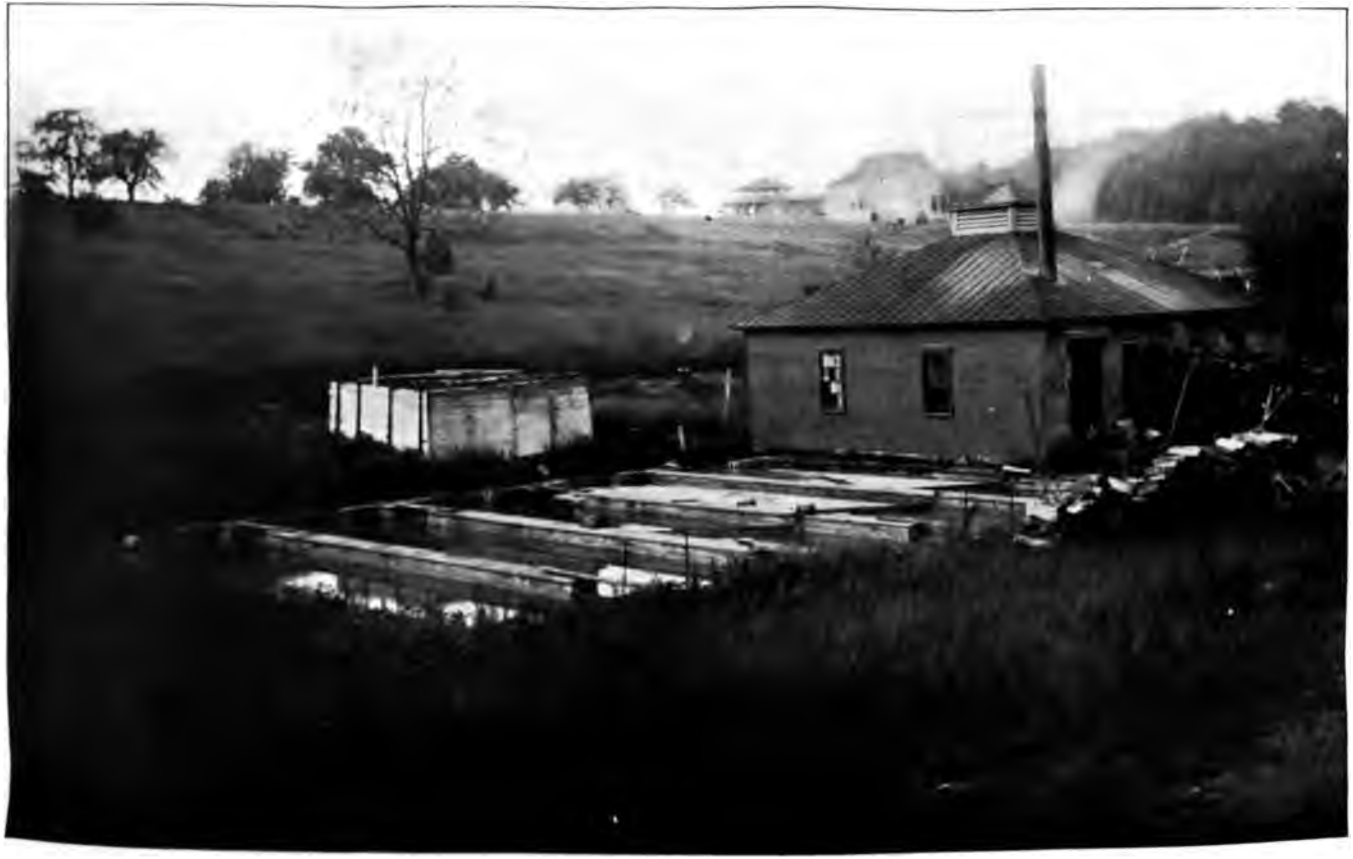
The water supply is that furnished by the municipality of Greater New York.

To care for the sewage in this territory three purification plants, or "caissons," of the so-called Powers type, have been built. Plant No. 2 is located just back of Luna park and receives the sewage of Coney Island proper; plant No. 3 is about 500 feet from the highway at the rear of Manhattan beach, is a duplicate of plant No. 2, and receives the sewage from the territory surrounding Coney Island proper; and plant No. 4 is situated about a mile east of Sheepshead bay, receiving the sewage from Sheepshead bay. These three plants are under the supervision of the bureau of sewers, borough of Brooklyn, and are operated as a unit so that statistics for each individual plant in all matters are not available.

The population contributing sewage to plants Nos. 2 and 3 is normally about 9,000, but upon some summer days, transiently, reaches 300,000; and the population of the district supplying sewage to plant No. 4 is normally 2,000, but upon some summer days transiently reaches 50,000. The total area drained by these plants is 1,235 acres, being distributed among the three plants as follows:

Plant No. 2	625 acres
Plant No. 3	305 acres
Plant No. 4	305 acres

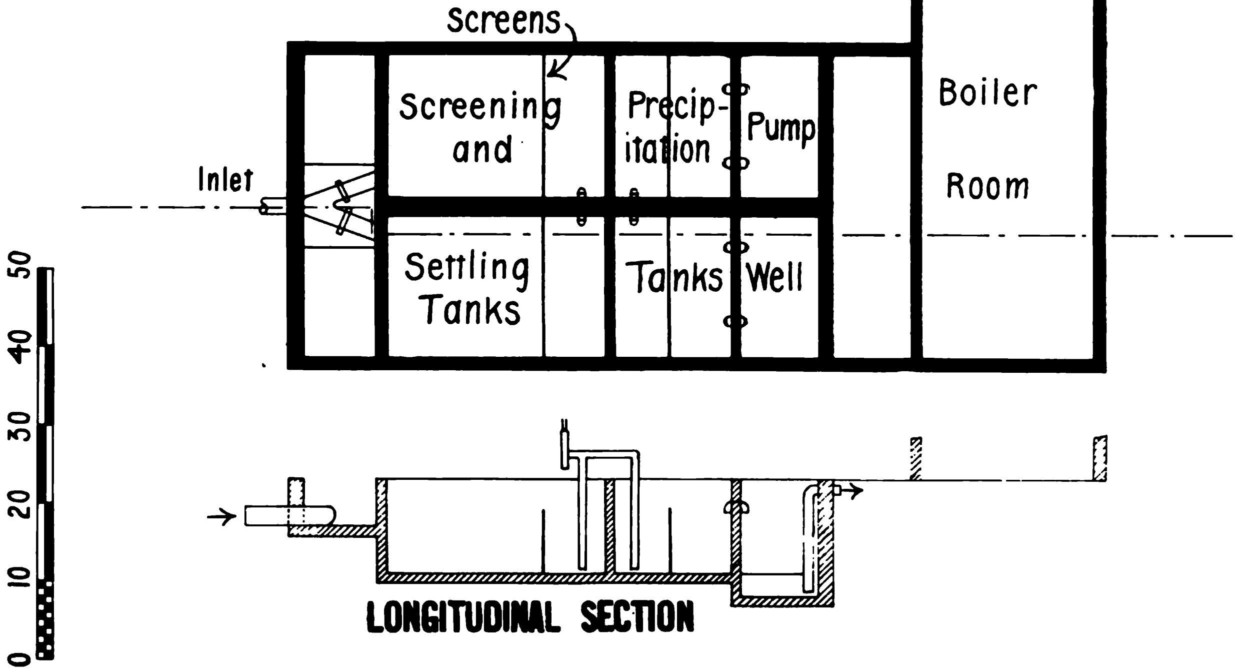
The sewerage system of plant No. 2 contains twenty-three miles of pipe in the receiving system, the purification plant 0.7 miles of twenty-four-inch cast iron effluent pipe, and was completed in May,



Chautauqua. Chemical Precipitation Plant.

CONEY ISLAND

CHEMICAL PRECIPITATION



1886; plant No. 3 has a collecting system of five miles length, the purification plant similar in detail and capacity to that of plant No. 2, 1.5 miles of twenty-inch cast iron effluent pipe, and was completed in October, 1887; and plant No. 4 has a collecting system of thirteen miles length, a purification plant circular in plan and similar to the plant at New Lots, about 500 feet of effluent pipe, and was completed in 1892. Six hundred and thirty connections have been made to the system feeding plant No. 2, 125 to the system feeding plant No. 3 and 230 to the system feeding plant No. 4. The buildings of the district feeding these three plants are chiefly residential, retail, business or amusement resorts.

The systems are not underdrained nor have storm systems been built as yet, so that both storm water and underground water may enter the three purification plants. The amount of storm water entering the systems is not known.

The daily flow of sewage into plant No. 2 is 1,500,000 gallons; into plant No. 3, 700,000 gallons, and into plant No. 4, 1,700,000 gallons.

The sewage is discharged from all three plants by the use of Davidson centrifugal pumps, plant No. 4 discharging into the sound near the plant, while plants Nos. 2 and 3 discharge into the sound through the same pipe about 0.75 mile from plant No. 2. These effluent pipes are submerged at high tide to a depth of several feet, but at low tide they are completely exposed. No complaint of disagreeable odors was heard at the outlet of plant No. 4, but at the discharging point of plants No. 2 and No. 3 the odor was reported by those living in the neighborhood as unendurable at times and particularly at low tide and when the atmosphere was humid.

In each plant the sewage is treated with lime water and, at times, with chlorine. How frequently the sewage is treated with chlorine could not be learned, but the indication in one case was that it was not used frequently. In all three plants the lime water is agitated by hand at intervals of from five to ten minutes.

In plants No. 2 and No. 3 the sewage enters the plant through a thirty-two-inch pipe. This pipe, by means of a Y containing valves, carries the sewage to one or the other of the two sets of chambers in each plant, through which the sewage may pass. There are three chambers in each series, the third chambers of the two series being connected by an open archway in the dividing wall between them and acting as a well from which the effluent is pumped into pipes designed to carry the same to the sound. In plant No. 4 the sewage enters a circular well, where it mingles with a stream of lime water which is constantly feeding into it. No mechanical appliance is used for mixing the sewage and the lime water in this well and it appears more than possible that some of the sewage is not brought into contact with the lime until it has passed partially or entirely out of the plant. The sewage is pumped from the well into semi-circular channels and after flowing through about 250 feet of these channels it falls over a weir and passes into the effluent pipe, discharging into the sea about 500 feet from the plant.

The sludge from all three plants is pumped from the sedimentation tanks upon the soil adjacent to the plants and is used for raising the surface level.

Chemical analyses of the raw sewage and of the effluent are now in progress, but are not yet available.

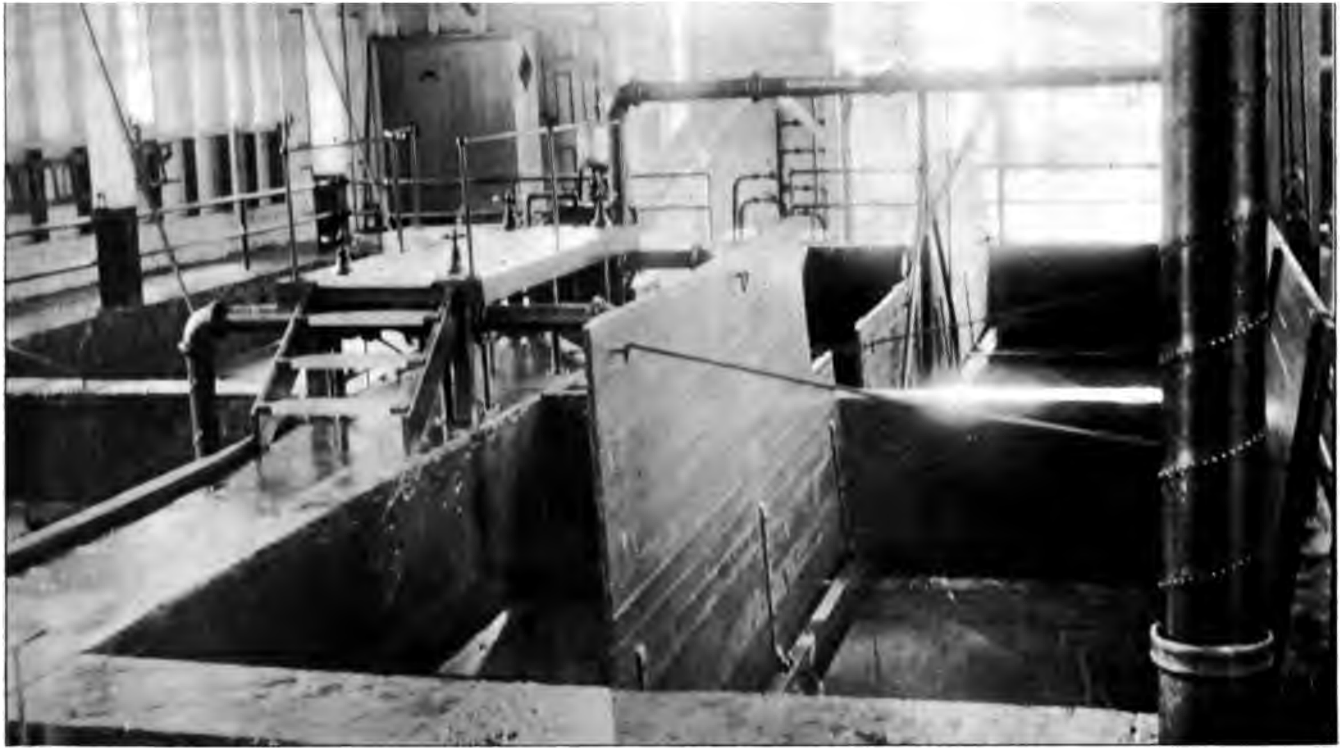
The cost of the three sewerage systems and of the three purification plants is unknown.

The annual cost of operation of the three plants combined for the year 1906 was as follows:

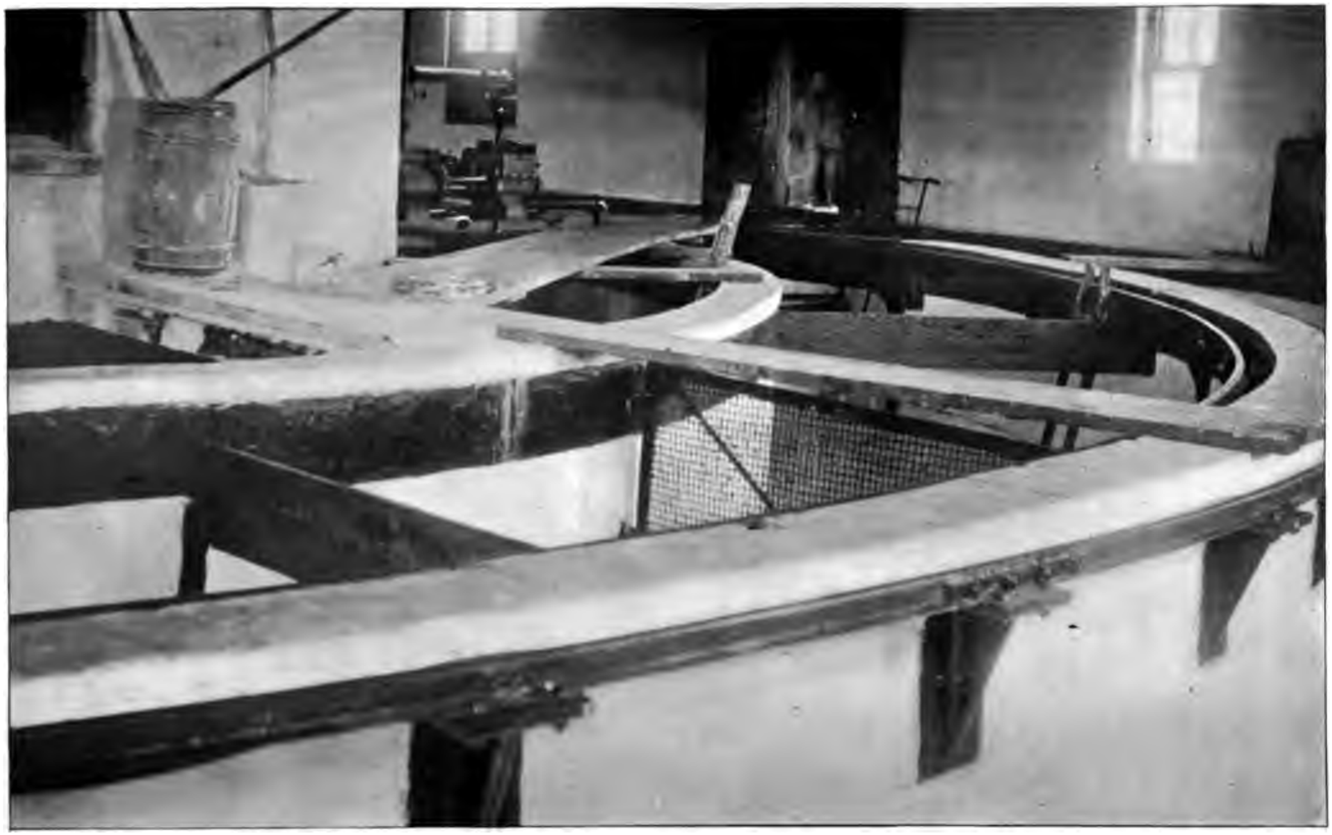
Chemicals and repairs	$9,622 65
Labor, skilled and unskilled	31,684 92
Total	$41,307 57

If the cost of operation of the individual plants be based on the amount of sewage treated at each plant the cost of operation of individual plants would be as follows:

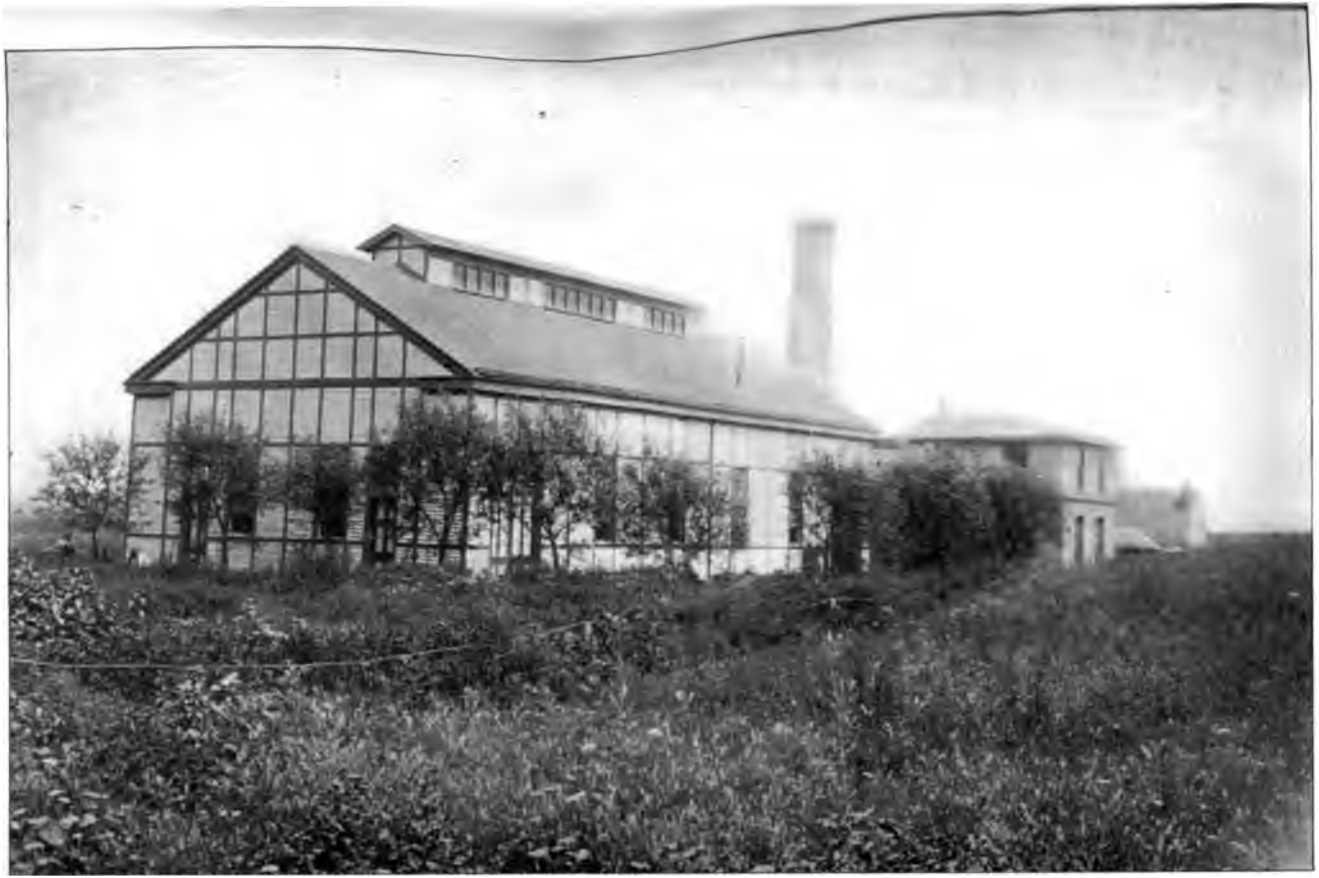
Plant No. 2. Chemicals, repairs, labor, skilled and unskilled	$15,887 54
Plant No. 3. Chemicals, repairs, labor, skilled and unskilled	7,414 20
Plant No. 4. Chemicals, repairs, labor, skilled and unskilled	18,005 83
Total	$41,307 57



Coney Island. Interior No. 2. Duplicate No. 3.



Sheepshead Bay. Another Interior View.



Coney Island. Exterior No 3. Duplicate of No. 2.

References: Rafter and Baker, "Sewage Disposal in America," pp. 369–382.

The illustrations show, first, an interior view of plant No. 4, with its circular channels. The screen is shown and the general arrangement of the interior. A view of the exterior of the New Lots plant is similar to the exterior of this plant.

The second and third views are the exterior and interior of the other two plants, which are practically identical.

CORINTH

The village of Corinth had a population of 3,000 in 1900 and a population of 3,272 in 1905. The sewage system was designed for a poulation of 5,000, so that it is apparently ample in size for some years to come. The watershed of the village of Corinth flows into the Hudson river, and the system is in two sections, the one having its outlet into the Hudson river below the mills of the International Paper Company and comprising that portion of the village known as Palmer Falls, and the other outlet discharging into the Hudson river at River street. At both of these points settling tanks have been provided in order that the solid matter may be kept from the river. They are so arranged that in the case of the River street outlet the effluent from the tank cannot be discharged onto either contact beds or filter beds with out pumping, but a receiving tank has been provided for to receive the effluent of the settling tank from which the sewage will be pumped. The Sixth street outlet is located at an elevation sufficient to allow a flow to either contact filters or beds. The tanks are so designed that, in times of high water, sewage will pass around the tanks through the by-pass, and the tanks are protected by the flap valve at the outlet and the screw gate at the inlet from the high water. They are also provided with an overflow to act in the case of any stoppage in the tank. A weir is arranged at the outlet for the purpose of governing the amount of flow to determine the time occupied by the sewage in passing

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[1] Condensed from the Reports of the State Department for the year 1908, page 89.

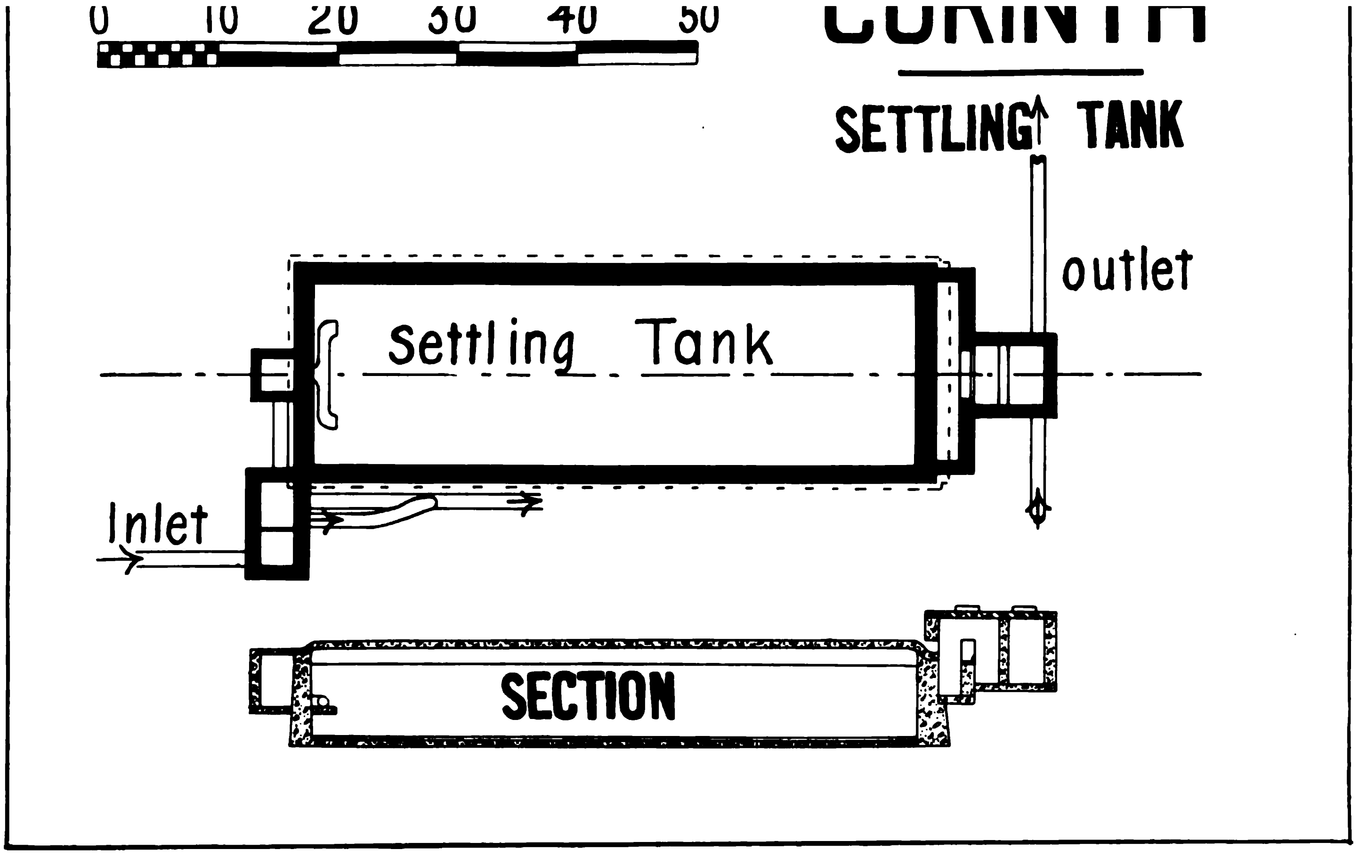
through the tank and afford an opportunity to examine the effluent. The draining gate is at the elevation of the inlet. This permits the sewage being drawn off to that level and the sludge deposit pumped out. The tanks are planned to each care for 9,000 cubic feet of sewage in twenty-four hours. This is based on a flow of sixty gallons per head per day for the present population. The tanks may be enlarged at any time by building additional tanks connected with the present inlet gate chamber.

DANSVILLE

Dansville, a village having a population of 4,000, is located on Canaseraga creek some fifteen miles above its confluence wi the Genesee river.

The water supply is obtained from Mud and from Mill creek. The supply from Mud creek, a spring-fed stream, is collected in a rectangular reservoir situated about 150 feet above the village o the hill to the south and east and has a capacity of about 3,500,000 gallons. In the distribution of this supply the water passe through 13.6 miles of pipe varying in size from twelve inche to four inches. To this distribution system 782 service pip have been laid practically supplying the entire population of th village with a supply of water which is good and ample.

The sewerage system has been built during the past two year and embraces about thirteen miles of piping and the disposa plant. To the thirteen miles of piping, 190 connections hav been made, connecting about 1,000 people, or one-fourth of th population, with the sewerage system. Of these 190 connection four are hotels, one is the Blum Shoe Company, one the Jackso Hose Company, and another the Jackson Sanatorium, a healt resort having an attendance varying from 150 to 400 with a average of 300. The sewer system is partly underdrained bu the underdrains have no outlet, being intended for use onl during the construction of the sewer system. The sewage is purified by passing through a settling tank and through contact beds. A separate storm system has been installed at a cost of $11,000.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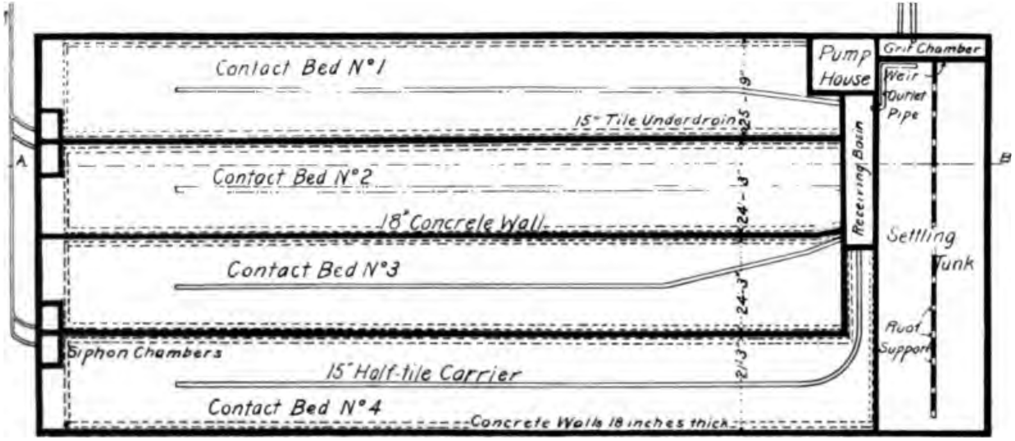
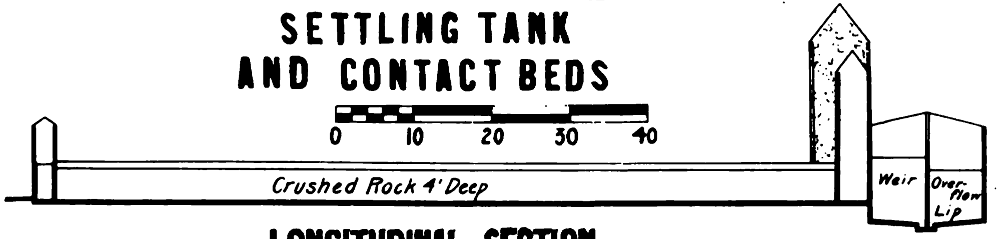
CORINTH
SETTLING TANK
outlet
Settling Tank
Inlet
SECTION



DANSVILLE
SETTLING TANK AND CONTACT BEDS



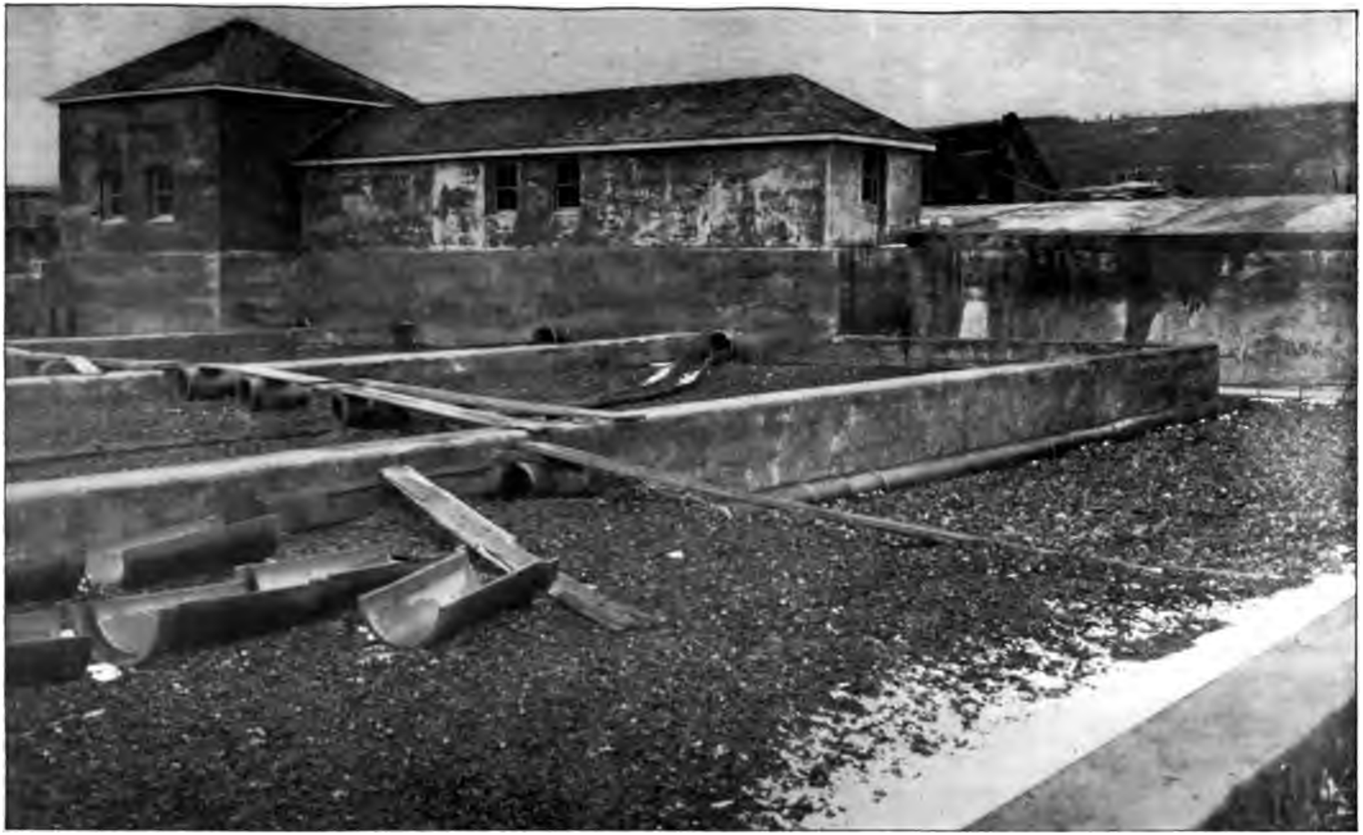
LONGITUDINAL SECTION

The disposal plant has been in operation at this time, June, 1907, but about a month and no measurements of the actual flow of sewage have been made but 40,000 gallons per day would perhaps be a fair estimate.

In undergoing purification the sewage first enters the grit chamber through a twenty-four-inch cast iron bend. Separating the grit chamber from the settling tank is an eighteen-inch concrete wall, half of which is nine feet high and half of which is seven and four-tenths feet high. The sewage falls over the weir formed by this wall into the settling tank the outlet of which is so placed that the depth of the sewage in the tank is about seven and three-tenths feet. Sewage enters the tank outlet at a point four feet above the bottom of the tank and discharges into the receiving basin at a point seven and three-tenths feet above the bottom of the tank. Two sludge channels, built in the floor of the tank, and separated from the grit chamber by sluice gates only, enable the tank to be connected with the grit chamber and both to be cleaned by pumping. The pumping is to be done by electrical power through a six-inch suction pipe.

In the receiving basin has been placed the U. S. Shields automatic mechanism which consists of a series of bells connected to each other and to gates at the four outlet pipes of the receiving basin. These bells are connected in such a manner that when the sewage accumulates to a depth of about two and six-tenths feet in the contact bed air pressure automatically closes the gate at the intake pipe of the first bed, opens the gate of a pipe feeding into a second bed, and diverts the flow to the second bed. There are four of these bells regulating the flow upon the contact beds.

From the receiving chamber the sewage passes through one of four contact beds from 200 to 210 feet long and from 21 to 26 feet wide. As the sewage leaves the receiving basin it flows upon the surface of the contact bed through a line of twelve-inch vitrified half tile. The joints are loosely laid and the sewage leaves the carriers at every joint. This tile is laid in the center of each bed and to a point about thirty-six feet from the lower end of the contact bed. Around the bottom of these beds has been placed a line of twelve-inch vitrified tile drain and over this drain pipe has been placed two and six-tenth feet of crushed stone of uni-



DANSVILLE. DISPOSAL PLANT.

form size, being about that of stove coal. At the lower end of each contact bed has been placed an automatic timed siphon. These siphons are so arranged that the sewage stands in the beds for any desired time before the gate valve to the discharge pipe is opened. From the beds the sewage then passes directly through the discharge pipe a distance of about 650 feet into Canaseraga creek. As adjusted at the present time the sewage flows upon the beds for one hour, stands for twenty-five minutes in the bed, empties in fifty minutes, and then the bed rests one and three-fourths hours.

Nothing definite concerning the amount of ground-water entering the sewerage system or the chemical composition of the sewage is known. Two samples of the effluent taken for a putrescibility test showed no indication of putrescibility in six and one-half days.

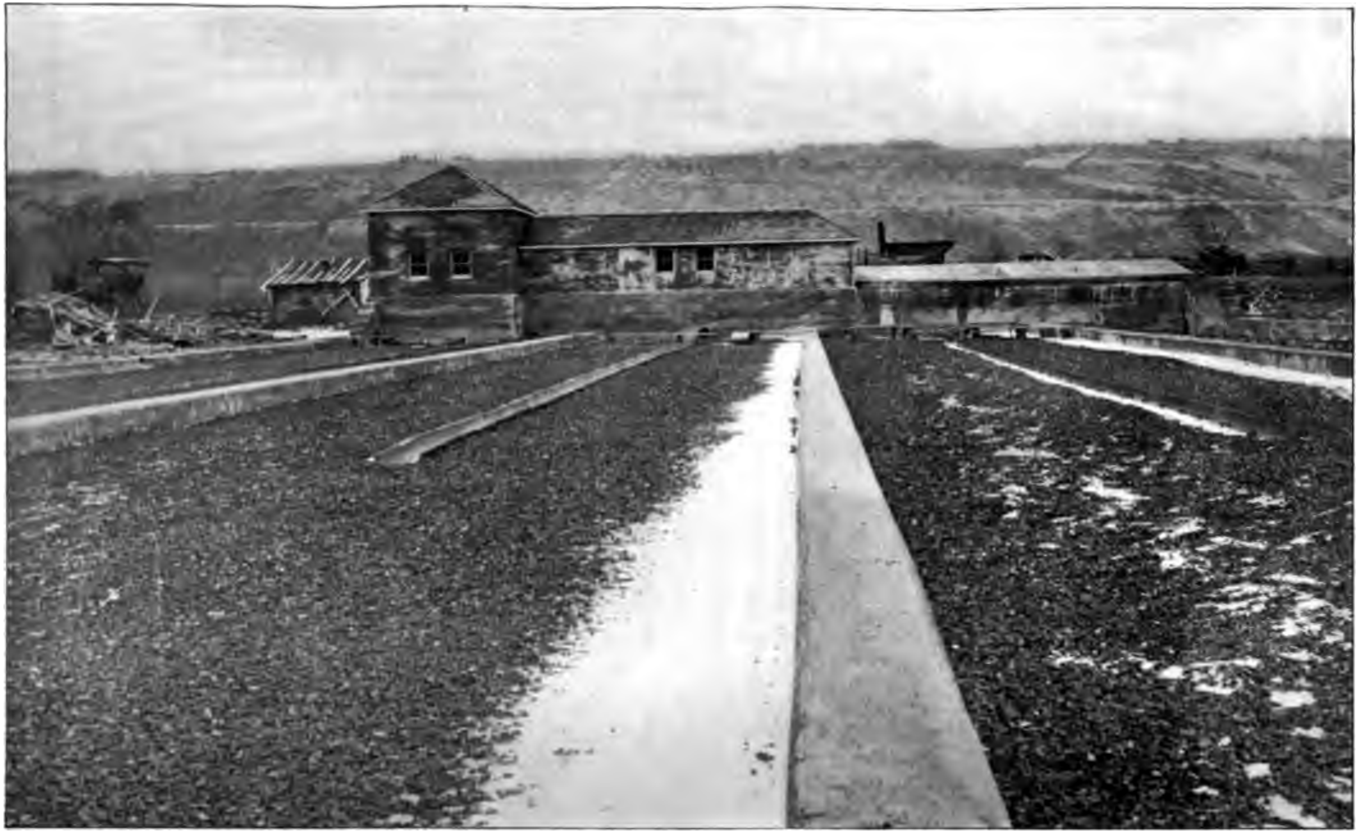
The discharging pipe is so laid that the outlet end is partially below the surface of Canaseraga creek. This stream at times rises as much as five feet above the end of the pipe, and to prevent the creek water from backing up this pipe an iron door, hinged on its upper side, was hung over the end of the pipe. Flow into the pipe tends to close this door, while flow from within cannot take place until the water pressure against and the action of gravity upon the door have been overcome.

If, at any time, it is desired to divert the flow from the settling tank, a valve placed in the twenty-four-inch pipe leading to the tank may be closed. In a manhole about twenty feet from the tank the closing of the valve causes the sewage to overflow and to pass over a weir directly into the discharging pipe. If, for any reason, the gate valves in the receiving basin are not lifted the surface of the sewage rises in the tank until at the elevation of the lip of the stone weir in the manhole when discharge again takes place over the weir and into the discharge or effluent pipe.

The disposal plant was designed by Knight & Hopkins of Rome, N. Y., and the total cost of the sewerage system, the disposal plant, the property on which the plant was built, the storm system and engineering services rendered was $95,000.

The illustrations show the contact beds and the house built over the settling tank. One view shows one of the contact beds during construction, and the other the completed bed.

Dansville. Disposal Plant.



DANSVILLE. CONTACT BEDS AND SETTLING TANK.

DEPEW

From personal investigation and from the description given by G. Everett Hill in volume No. 47 of the Engineering News.

The village of Depew lies about ten miles east of Buffalo. It is principally a manufacturing community, and its main industries are foundries and machine shops connected with the railway interests. The village was laid out by these same industries and the population is composed mainly of mechanics employed in the shops and are separately housed in buildings which are, as a rule, small and plain. The population is about 3,300, but of this number only 1,845 are connected with the sewage disposal plant. The sewage from the remaining 1,460 is discharged into Cayuga and Scajaguada creeks.

The water supply of Depew is taken from Lake Erie at a point one mile from the shore and is supplied by the Depew & Lake Erie Water Company. The water is pumped from the lake into a reservoir at Depew, having a base 80 feet square and top 180 feet square, and a capacity of 3,000,000 gallons. From this reservoir the water is distributed by pumping through about 450 service pipes at the rate of 500,000 gallons per day.

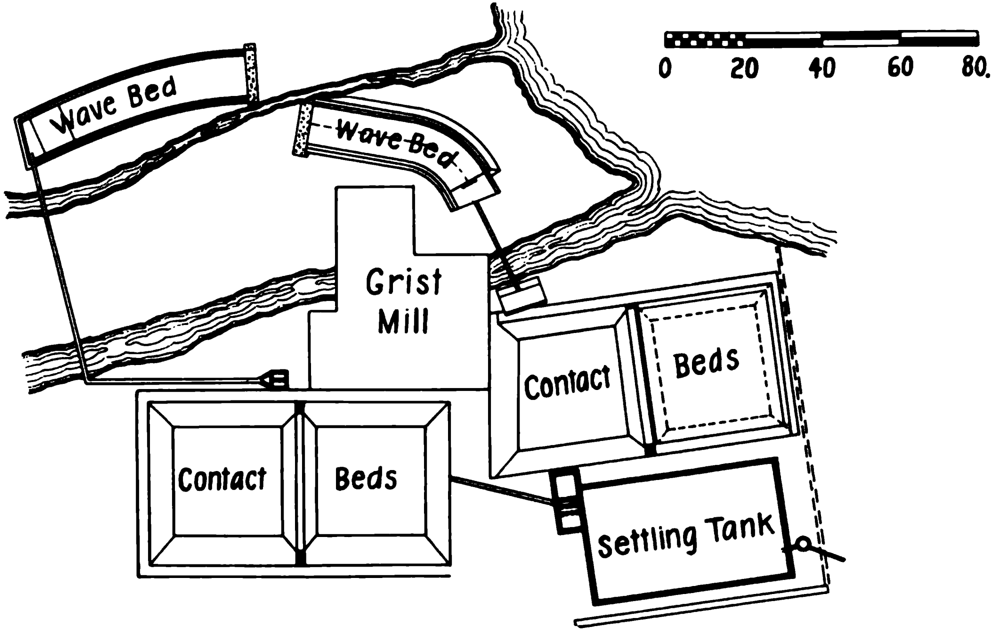
The present estimated daily flow of sewage is 331,000 gallons, with a population of 1,845 furnishing sewage to the plant, making the daily flow per head about 180 gallons. Probably a large proportion of this apparent excess is due to the fact that street drainage in considerable quantity is allowed to drain through the disposal plant. There is also undoubtedly a large amount of ground water entering the system. The installation of purification works was undertaken in 1900. Circumstances made it necessary for the plant to occupy the least possible area, to be low in first cost, and to maintain its own operating expenses at a minimum. The works include a settling tank, coke primary filters or contact beds and secondary stone filters, the latter operated on the wave bed principle.

The design and operation of the plant may be stated as follows:

The incoming main sewer ends in a manhole which communicates with the settling tank, which contains 94,500 gallons, or with a flow as stated, about one-quarter of the daily flow. The effluent escapes at the further end in a condition such that no visible solids are perceptible in solution, and on standing deposits a sediment which is barely perceptible. From this tank the clarified sewage passes into a distributing chamber whence four lines of pipe lead respectively to four coke filled primary filters. The primary beds are about thirty-three feet square and about five feet deep. The automatic mechanism holds the beds ful for a certain time, and then automatically opens the outlet valve by which in turn and by means of an automatic siphon the contents of the beds are suddenly discharged onto the secondar beds. These secondary filters or wave beds are twelve feet by sixt feet in area and are built on a slope of 1-15. Around the upp end of each bed and along its inner side is a brick retainin wall to carry away surface wash from the higher land. At th upper end of each wave bed the ground is paved with brick t catch and break the force of the strong sudden discharge fro the siphons. The broken stone of which these beds are made i fifteen inches deep at the upper end on the brick pavement, an eight inches deep at the lower end. The effluent from the contac beds is practically purified when it reaches these wave beds an travels through this thin stone layer in a wave, each wave driving out the gaseous contents of the filtering material and drawing fresh air in behind. Aëration is very complete, and no trac of stored organic matter has ever been evident in these wave beds The effluent is generally clear and odorless, but for various reasons the plant has been occasionally out of commission. Th plant was designed by the City Wastes Disposal Company, of New York, and built under the supervision of F. K. Wing, o Buffalo.

DOLGEVILLE

Dolgeville village is situated on the banks of East Canada creek, about eleven miles from Little Falls. The population is 2,400.



DEPEW

SETTLING TANK, CONTACT BEDS & WAVE BEDS

The Dolgeville water supply is taken from Cold brook, three and three-quarter miles from the village. At this point the brook has been impounded by the building of an earth dam forming a reservoir covering a half acre of land. The water is eight feet deep at the lower end, three feet deep at the upper end and the minimum flow of the stream is about 2,400,000 gallons daily. No measurement of the amount of water used by the village has been made but it is nearly 350,000 gallons daily. The water surface is from three and one-half feet to four feet above the opening of the twelve-inch intake pipe. Three and three-quarter miles of twelve-inch pipe carry the water from the reservoir and about seven miles of pipe distribute the water around the village. Four hundred and eighteen service pipes, connecting 430 houses, have been laid. Included in this number are five hotels, two school buildings, a laundry, two stores and two town buildings. The water supply is both good and abundant.

The installation of the sewerage system was undertaken in 1904, but due to unforeseen circumstances, is just being completed. Nearly six miles of pipe, ranging in size from six inches to eighteen inches, underdrained by three and one-quarter miles of four, six and eight-inch pipe, the settling tank and seven flush tanks make up the system. The underdrains empty at various points into East Canada creek. The flush tanks have a discharging capacity of ninety-five gallons and are adjusted to discharge once in twenty-four hours.

The sewage is to be purified by sedimentation and after flowing through the collecting system will enter the inlet or grit chamber of the settling tank. From this it will flow over a metal protected concrete weir into the main tank, the weir being two openings in the wall separating the grit chamber from the main chamber. After flowing from one end of the tank to the other and back again on the opposite side, a distance of about 175 feet, the sewage flows over a second weir, similar to the one described above, into the outlet chamber. From this chamber the sewage flows through about fifty feet of eighteen-inch pipe into East Canada creek emptying below the surface.

The cost of collecting system, including seven flush tanks at $80 each, the laying of the drains and underdrains, and fourteen

lamp holes, at $12 each, one inverted siphon at $500, thirty-
manholes less than ten feet deep at $45, twenty-eight manh
over ten feet deep at $50, and the backfilling, was $35,37

The tank was designed by Mr. H. B. Cleveland, of Am
dam, N. Y., and cost approximately $7,000. In design i
similar to the tank at Skaneateles, N. Y.

The illustration shows the small building built over the
chamber, the sedimentation tank extending out under the
tation to the very front of the picture.

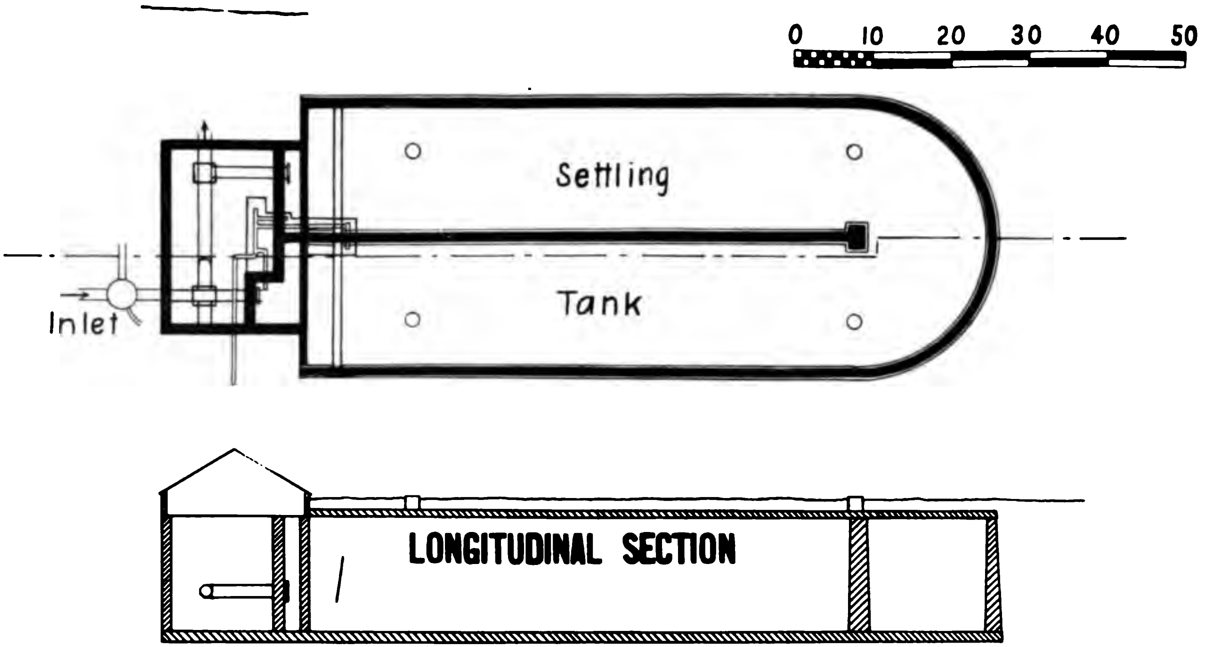
In connection with the Dolgeville sewage system a small
feet by sixteen feet concrete tank has been installed at the Br
woldt lumber yard. The cost of connecting this plant, wh
employs about 120 men, with the village system would have
so great that it was decided to build a small tank on the p
erty of the company at a cost of $400. The sewage when
charging stands at a depth of five feet eight inches. On
small quantity of scum was found on the surface and there
no sediment in the bottom of the tank which has been in
since the fall of 1906. The outlet pipe is a six-inch pipe
discharges at the water's surface into Cedar creek at its j
tion with East Canada creek. There is no danger of back w
ever troubling the operation of the plant as the tank is
twenty-five or thirty feet above the creek surface.

The effluent was clouded, had a slight odor and showed i
cations of putrescibility in twenty-four hours.

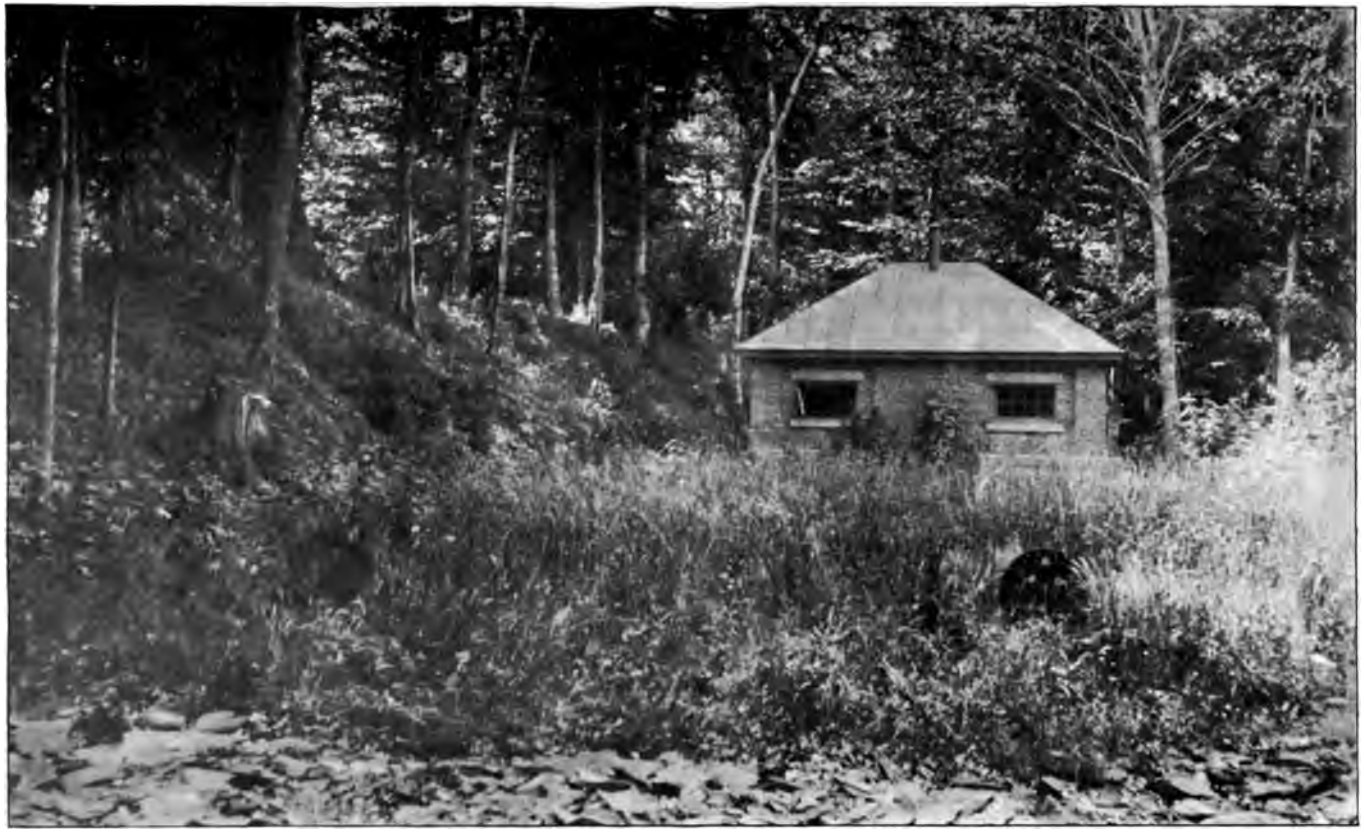
EAST SYRACUSE

East Syracuse is a village of 3,000 inhabitants and is loca
about a mile west of Butternut creek. Its drainage enters
Oswego river by way of Chittenango river and Oneida lake.

The water supply is obtained from a spring-fed stream n
Jamesville and is carried through eight and one-half miles
pipe to the village. At the receiving point a concrete cham
fifty feet long, ten feet wide and four feet deep has been bui



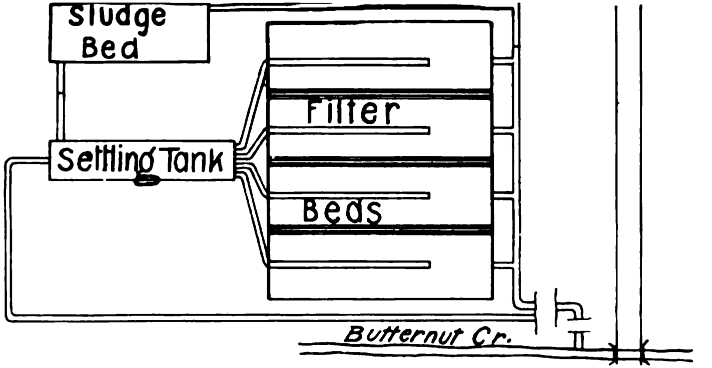
DOLGEVILLE
SETTLING TANK

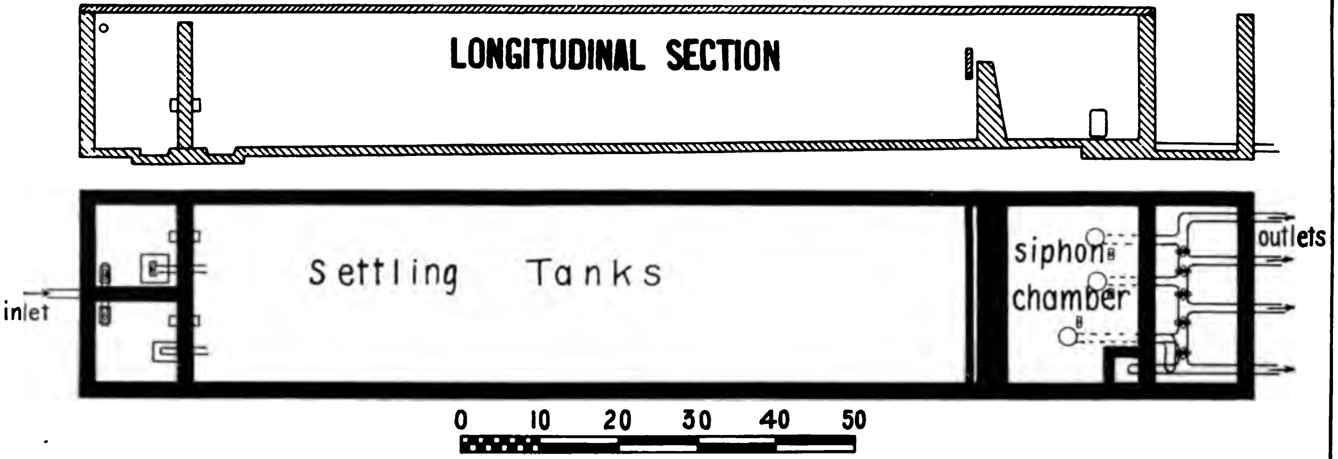


Dolgeville. Circular End of Settling Tank Located at Point Where Vegetation Ceases.

EAST SYRACUSE

SETTLING TANK AND STONE FILTER BEDS





From this channel the water flows about one-quarter mile to a receiving well. After passing this well, which acts as a catch-basin, the supply flows into a reservoir about one and one-quarter miles from East Syracuse. This reservoir has a capacity of 2,000,000 gallons and has sufficient elevation to give a pressure in the mains of from fifty-five pounds to sixty pounds. The water supply is abundant and said to be of good quality. The reservoir is a natural one but it was found necessary to place clay in the bottom to prevent leakage from the reservoir. Two hundred thousand gallons are used daily or sixty-seven gallons per head per day. In the village there have been laid about ten miles of water pipe and 650 connections have been made to the system.

The sewerage system embraces ten miles of vitrified tile pipe in the village, laid one and one-half years ago; an electrical pumping station which lifts the sewage nineteen feet at the two seventeen feet by twenty feet by seven and one-half feet sewage wells to the surface and about twenty-seven feet more into the settling tank, an operation saddling the village with a monthly burden of $400 for electrical power and over $100 for labor at the pump. There is also included 8,300 feet of eight-inch iron pipe leading from the sewage wells to the disposal plant; the settling tank and filter beds; and 3,000 feet of ten-inch vitrified tile pipe leading from the disposal plant to Butternut creek. The system was built about a year and a half ago and at present about 1,700 people, or slightly more than half of the population, are connected with the system. It is intended to purify the sewage by means of sedimentation and filter beds, crushed stone and sand being placed in the filter beds. Three hundred and forty connections have been made to the system, furnishing a purely domestic sewage. These buildings are largely residences, two or three being hotels. The system was underdrained only where it was found necessary in the construction of the sewers.

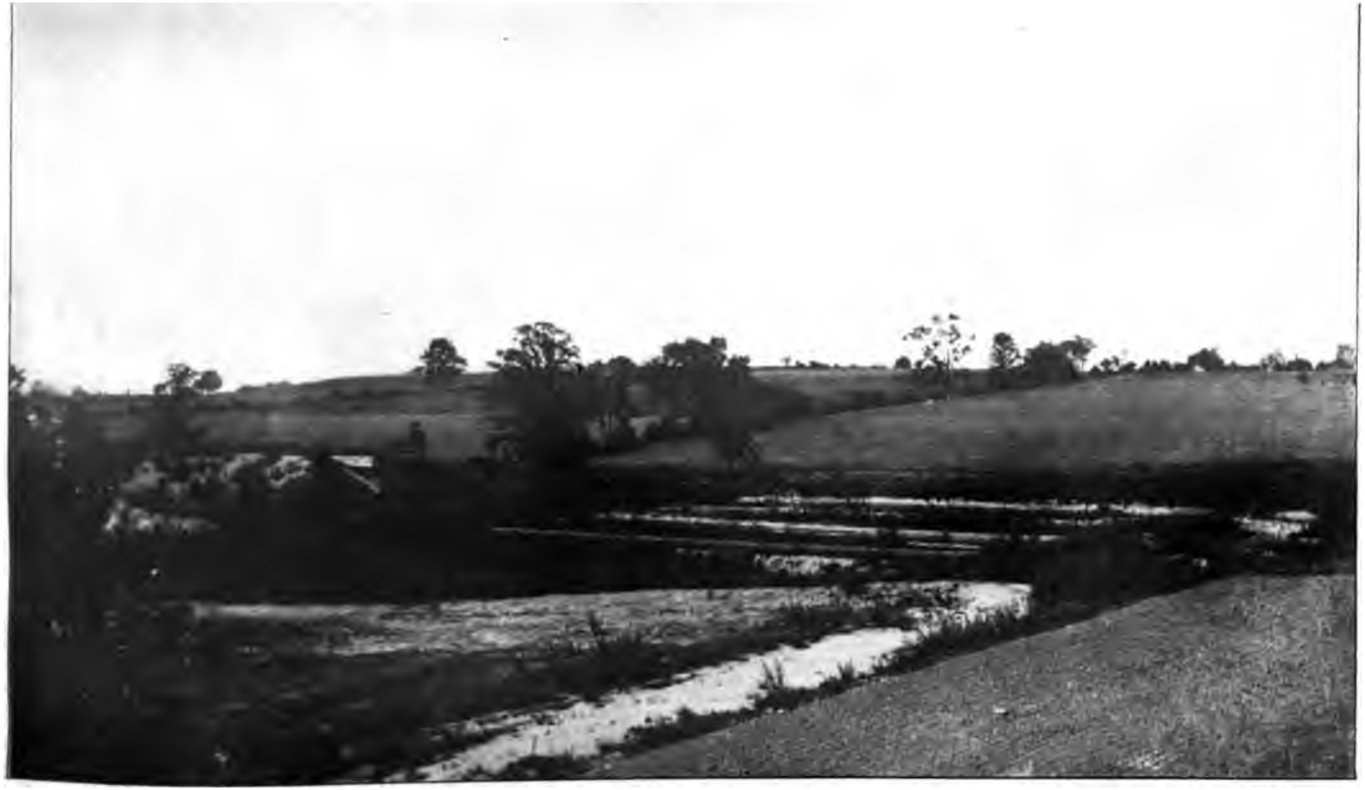
The quantity of ground water entering the system is large and is responsible for the high cost of pumping and for the high frictional losses which are found to exist in the pumping main.

The sewage enters one of two grit chambers about eight feet square from the force main and accumulates to a depth of four feet. There it flows through a straight iron pipe into settling chamber which is eighty feet long and eighteen f wide. From the settling chamber it flows over a concrete w into the siphon chamber and enters one of three autom siphons. Adjacent to the siphon chamber is the valve w which is to be housed, and in which have been placed the va which enable the attendant to cut out any one of the four fi beds. The grit chambers, the settling chamber, the sip chamber and the valve well are all built in the same concr vault. This was built with its base on the natural surface a is protected on its sides and top by an earth embankme From the siphon chamber the sewage flows through a ten-in pipe and a trough distributor upon the filter beds.

The distributor has a flat bottom and is about three feet wi at the intake end and eighteen inches wide at the lower end. has a depth of three inches and at six to eight points along ea side it has small four-inch lateral channels leading from it whi carry the sewage upon the beds. The flow into these laterals regulated by a hinged gate. After leaving the distributors t sewage filters through three feet of sand of three grades (si not available) and one foot of crushed stone having a size tween chestnut and stove coal. Each of the four beds is 1 feet long, forty feet wide and has a filtering area of 0.09 acr When the beds are in use the sewage is to flow upon each bed three days and then the bed is to be allowed twenty-four hou rest. Each bed is underdrained by six lines of four-inch f drain pipe running the entire length of the beds. Sewage not yet been passed through the tank or beds and it is impossi to say anything regarding the actual operation and behavior the plant. The amount of pumping necessary to lift the sew to the septic tank and to force it through the 8,300 feet of mai from which the leakage is large, makes the cost of operation great that at the present time the sewage is not being regula pumped, and a vigorous effort is being made to devise a plan carry the sewage to the disposal plant in a more economi manner.

The solid matter from the sludge chamber is to be wash through an eighteen-inch pipe upon a sludge bed 100 feet lon

EAST SYRACUSE. VIEW ACROSS FILTER BEDS.



EAST SYRACUSE. DISPOSAL PLANT.

30 feet wide and containing a depth of 3 feet of crushed stone. At one side of this bed in a trench two and one-half feet deep has been placed a ten-inch drain which is covered to a depth of five and one-half feet with crushed stone and which carries the liquid portion of the sludge received by the contact bed to the discharge pipe at a point below the filter beds.

The sewage is a very weak one because of the large amount of ground water entering the system.

As the plant was not in operation nothing concerning the effluent can be said. The outlet pipe is laid in the same trench that the pipe leading to the settling tank is laid and empties into Butternut creek at the point where the creek is crossed by the highway. The outlet pipe is a ten-inch vitrified tile pipe and its discharging end is below the surface of Butternut creek.

The cost of the 5,600 feet of pipe leading from Butternut creek to and from the disposal plant, the disposal plant consisting of a tank, four sand filter beds, a contact bed and four acres of land, at $85 per acre, was between $18,000 and $19,000. The cost of laying the sewers to the pumping wells, of building the two wells, of building and equipping the pumping-house with a two horsepower induction motor, and the laying of 5,600 feet of force main from the pumping plant to Butternut creek was about $48,000.

The illustrations show general views of the plant, one a general view showing the filter beds and on the left the settling tank banked up with earth. The other view shows a nearer view of the surface of the filter beds.

WESTCHESTER COUNTY ALMSHOUSE, EAST VIEW.

(*Under Construction.*)

The Westchester county almshouse is located at East View and has an average attendance of about 325.

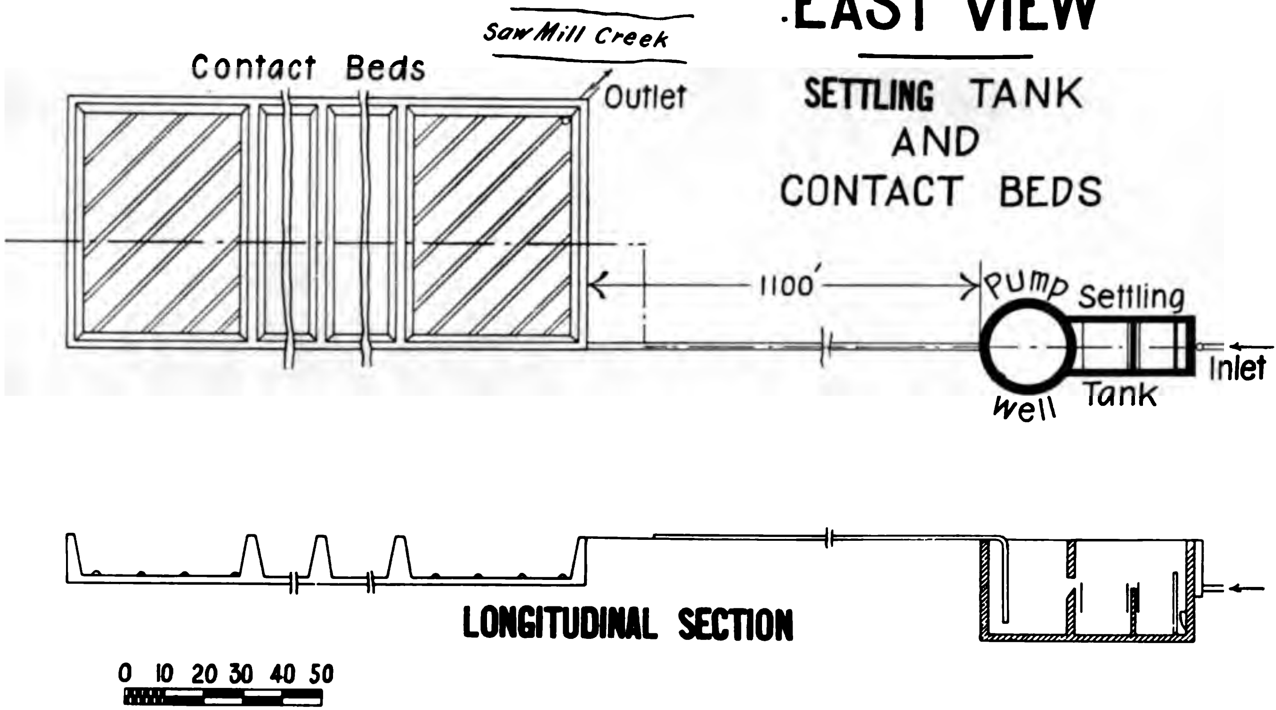
The water is taken from three concrete reservoirs fed by springs. One of the reservoirs is thirty-five feet square and twelve feet deep, a second is twenty-five feet square and twelve feet deep, and the third is twelve feet square and about nine feet deep, and the capacity of the three wells is 176,000 gallons. The supply is abundant and good and is furnished to the five buildings of the institution.

The sewerage system contains 500 feet of pipe necessary to carry the sewage from the institution to the rectangular tank thirty feet long, twelve feet wide and six inches to eight inches deep, a pumping well twenty feet in diameter, 1,100 feet of eight-inch pipe to convey the pumped sewage to the four beds of crushed stone, through one of which the sewage passes out into Saw Mill creek. At the present time the contact beds have been almost completed and the tank and pumping walls have been laid.

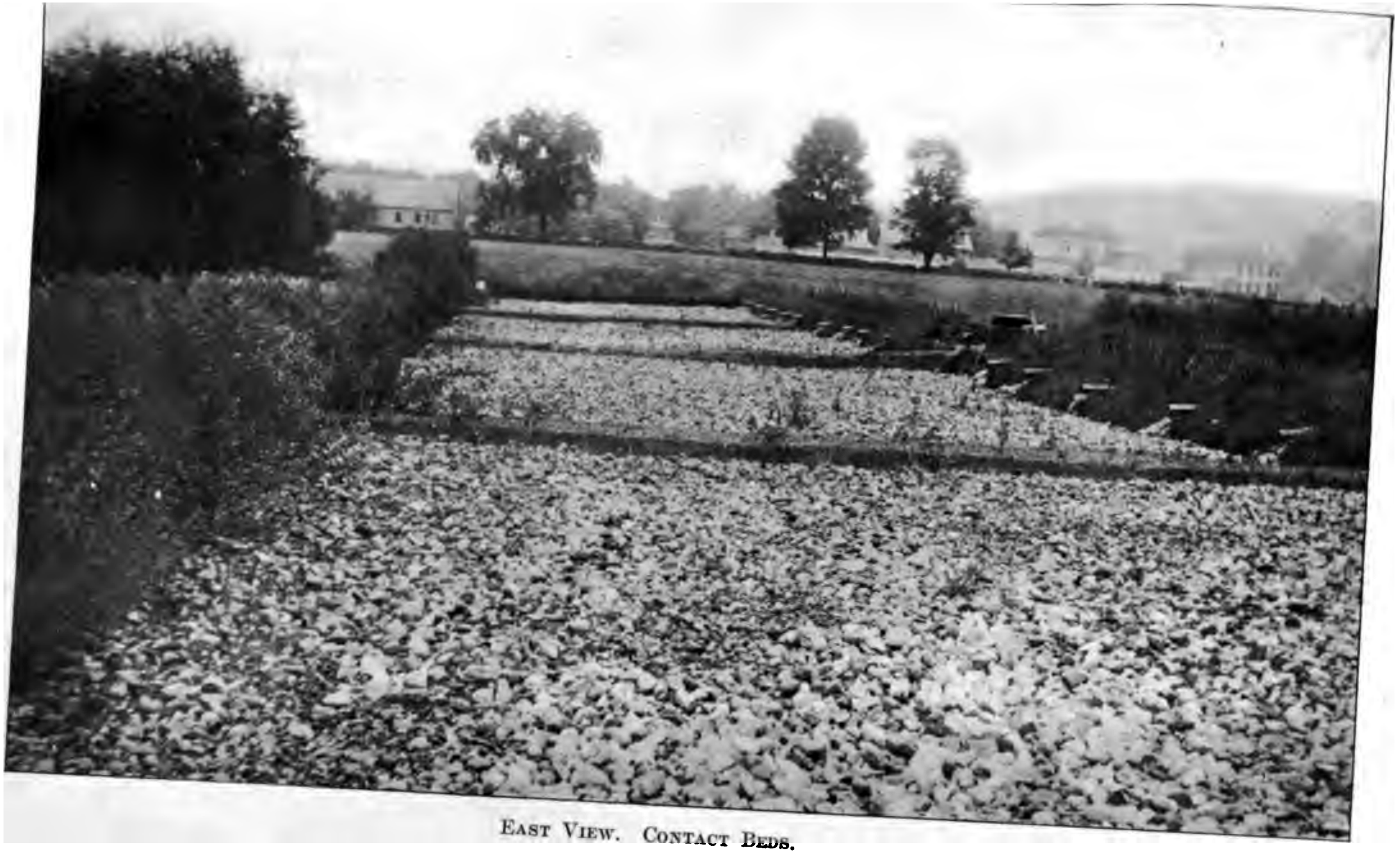
As the sewage enters the tank it will pass from an eight-inch pipe into any one of three six-inch pipes pointing downward, and emerging from these pipes it will strike against a corbel which will serve to break up the solid matter. A wall eight feet is built across the tank three feet from the point at which sewage enters, and in this wall are six six-inch by six-inch openings through which the sewage will pass from the grit chamber. At the center of the tank and across it is built another wall feet high but having no openings in it. One foot from it and on either side are to be placed two oak baffles which will reach to within three feet of the bottom of the tank and a few inches above the surface of the sewage. A third and similar baffle is placed near the outlet end of the settling tank. In passing from the tank to the pumping well the sewage passes through two openings in the dividing wall, the openings being four feet in length and about eight inches high. From the pumping well the sewage is to be pumped to the contact beds, a distance of about 1,100 feet. No valves have yet been placed, but the plans show that there are to be two valves, one on each side of the manhole opposite the center of the contact area. These, it seems, will allow the sewage to be discharged upon beds 1 and 2 or upon all four beds, but not necessarily upon 3 and 4 alone. The contact beds have row upon row of four-inch tile placed diagonally on their beds and feeding into an eight-inch vitrified pipe extending along the low side of the beds. Above the tile is placed a depth of five feet of

EAST VIEW

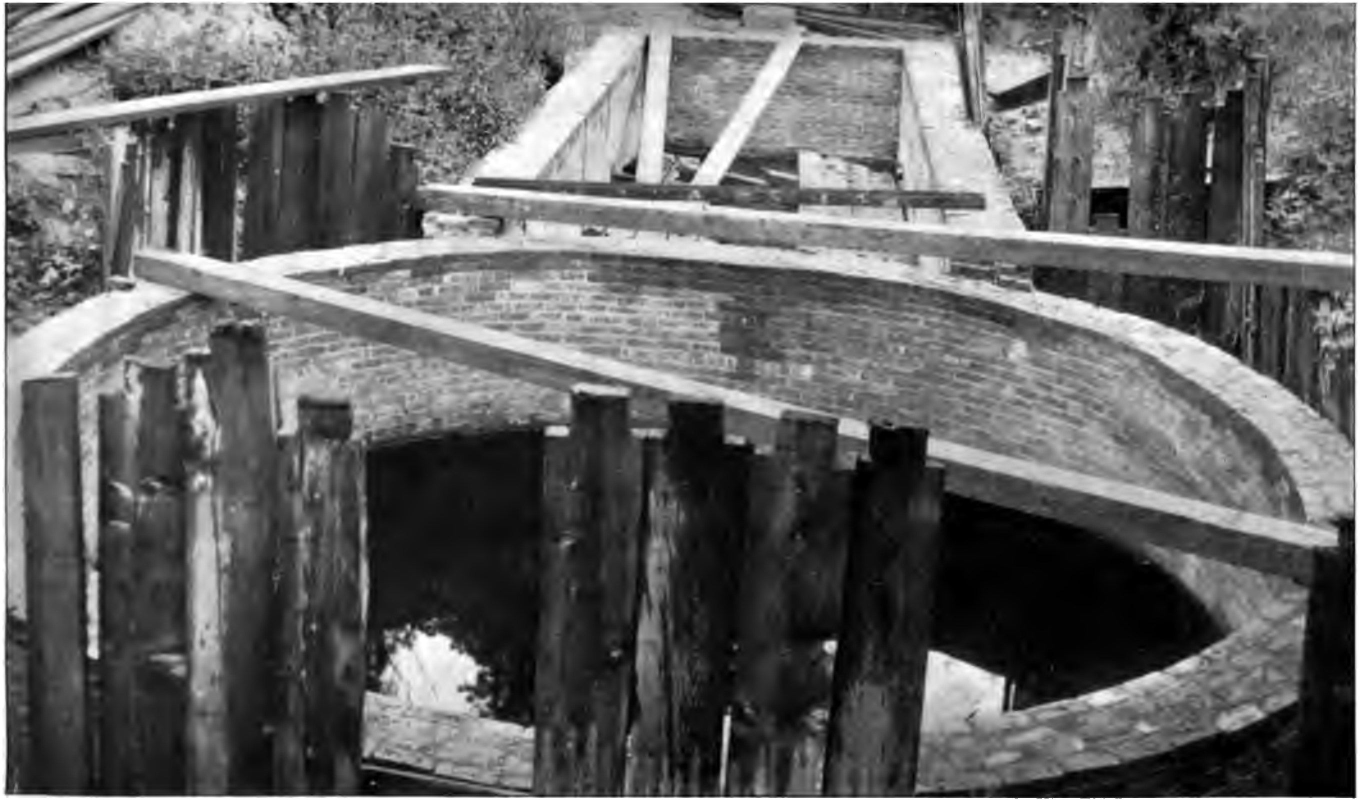
SETTLING TANK AND CONTACT BEDS



LONGITUDINAL SECTION



East View. Contact Beds.



East View. Settling Tank and Effluent Well.

ne screened from nearby soil and ranging in size from three
d four inches to one-half inch. There are no surface dis-
butors, the sewage being discharged at four or five points along
e side of each contact bed from six-inch pipes. Each bed is
rty feet wide, fifty-six feet long and is separated from adjoining
ds by an earth embankment about four feet wide and extend-
g one foot above the stone in the contact beds. Around the
ds has been built an earth embankment about five feet wide,
ving a slope of 1 to 1.5 and having its top about four feet
ove the top of the stone in the beds. The effluent from the
ds is to be discharged into Saw Mill creek at a point about
enty feet distant from the manhole; the effluent enters at the
d of bed No. 1.

The cost of the entire plant is $8,600.

The illustrations show the settling tank and pump well during
nstruction and the four contact beds.

ELMHURST[1]

About the beginning of the year 1905 a sewage disposal plant
s constructed at Elmhurst, a part of the borough of Queens of
v York city. The plans under which the construction pro-
led were submitted by Mr. Charles Hart of Brooklyn, the
ess recommended following that of the International Sewage
osal Company of Boston, Mass.

he plant is designed to treat 1,000,000 gallons of sewage per
and consists of a pump well and pump, four concrete sedi-
ation tanks, a flush tank and a sludge filter, all in a one-
brick building, together with three open sand filters having
ea of one acre. The sewage is delivered to the plant in a
y-four by thirty-two-foot brick pump well built in connection
the front portion of the building. Two nine by twelve-inch
ervice, direct acting duplex Worthington pumps elevate the
e from the pump well about ten feet and discharge it in a
iron pipe eight inches in diameter into the tanks. These

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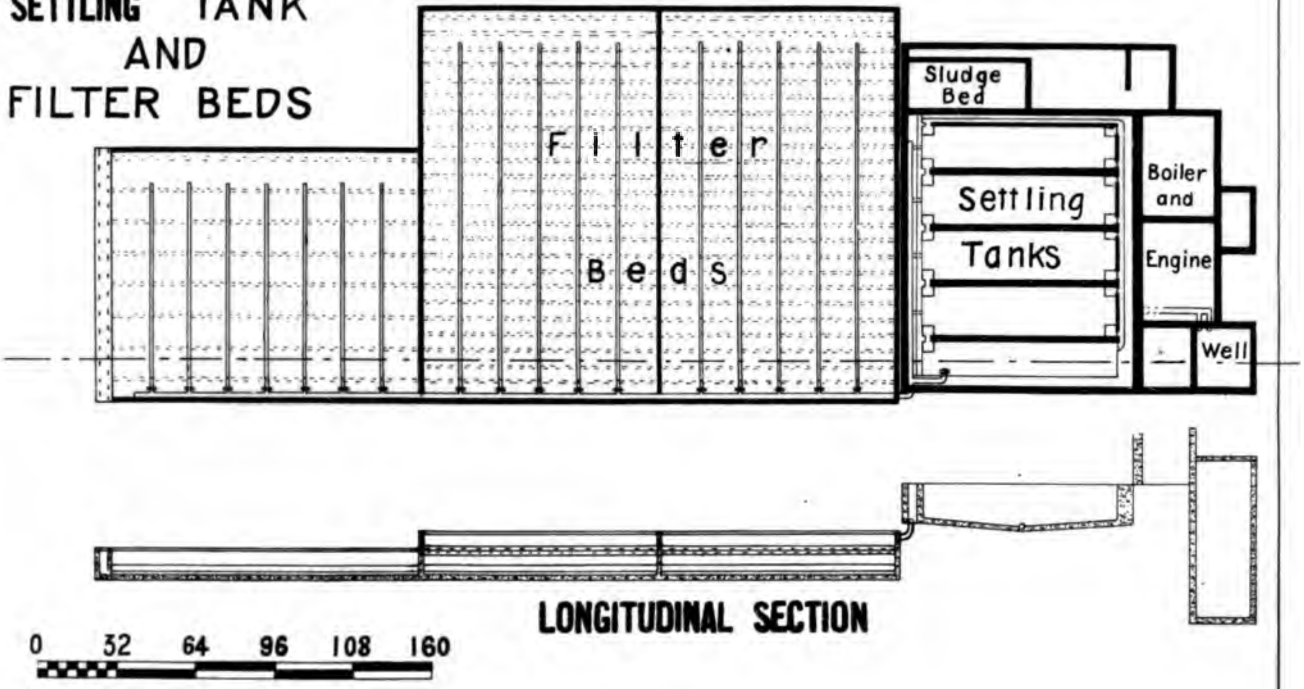
[1] Condensed from article in Engineering Record, volume 52, page 87.

tanks, four in number, as shown in the plan, are nineteen by eighty-two inches plan and five feet six inches deep. The flush tank is of the same length and depth, but fourteen feet wide. The discharge pipe from the pumps is connected with an open channel built in the top of the concrete wall at the front of the tanks. This channel extends the width of the row of tanks, with an inlet and an outlet opening from it into each clarifying tank and a single opening into the flush tank, the openings all being controlled by sluice gates. In the tops of the division walls between the tanks, at the ends furthest from the channel, are openings also controlled by sluice gates, which connect the adjacent tanks. The flow may thus be diverted from any tank or maintained from one tank to the next, the gates being arranged so that any one tank may be thrown out of operation without affecting the other tanks. The flow usually enters the end tank and, flowing continuously, passing into tank No. 2, then out into the channel, then into tank No. 3 and through the division wall into tank No. 4, then out into the channel and into the flush tank. It is automatically discharged from the flush tank at intervals through a sixteen-inch pipe leading to the filter beds.

All the gates are protected by partially submerged vertical shields to prevent the flow through them being drawn immediately from the surface of the liquid in the tank. These shields are made of galvanized iron, bent so as to form with the side walls of the tanks protected spaces about three feet square. The sludge discharge outlets are placed in the center of the floor of each tank and the floor surfaces are inclined toward them. These outlets are connected to a twelve-inch cast iron pipe laid longitudinally under the floor to the sludge filter and are controlled by hand operated valve with vertical stems extending up to a narrow platform supported by a wooden truss over the tanks at the middle of the building. For drawing off the supernatant clear liquid, at times of cleaning, a six-inch outlet from each tank is provided leading from a point at the mid depth of the tank into the main discharging onto the filters. The remaining liquid and the sludge are turned into the sludge filter in the adjoining portion of the building. The sludge filter is twenty by fifty feet in area and

ELMHURST

SETTLING TANK
AND
FILTER BEDS



three feet three inches deep, the size of material varying from three-inch stones at the bottom to sand at the top. Over the sand is placed about four inches of the fuel used for firing the boiler furnaces, buckwheat coal usually. Whenever sludge is discharged from the tanks, the heavy liquid passes by means of a twelve-inch cast-iron pipe onto the sludge filter by means of a transverse trough from which the liquid overflows onto the filter. The liquid passes through the filtering material to the underdrain and so back to the pump well. The sludge that is intercepted on the surface of the filter is scraped off and together with the fuel on the surface is dumped as a mixture in the coalroom and finally burned in the boiler furnaces.

Careful provision for ventilation is made throughout this plant, a complete system of ventilating ducts connected with a thirty-six-inch Buffalo Forge Company fan in the pumproom being installed for this purpose. The receiving pump well is ventilated and a system of underdrains in the filters, to be described later, are also connected.

The three filters at the rear of the building are arranged in a row, one bed next to the buildings, and the other two behind. They are built with concrete floors, side and division walls are made from 100 to 133 feet wide and from 114 to 153 feet long. The outlet pipe from the tanks is carried on concrete piers at one end with six-inch branch outlets, five in number for the first two beds and eight for the third bed, connected with open distributing drains laid on the surface of the sand. The drains are formed of twelve-inch vitrified clay sewer pipe split in half along the horizontal center. The total area of these beds is one acre, the rate of filtration, therefore, according to the design being 1,000,000 gallons per acre. In order to secure this high rate special provision for aëration has been made throughout the bed, the filter being constructed as follows: Lines of air ducts, formed by splitting ten-inch vitrified pipe along the longitudinal center line, are placed longitudinally in each filter on six-foot centers, with their convex sides up and their lower edges about two inches above the bottom of the layer of broken stone. These ducts extend the full length of the two beds and open to the air above the third bed. At the opposite end next the buildings they connect with an air chamber built in the concrete wall of the building. Thi chamber is connected to the fan in the pumproom by an eightee inch air duct laid with tight joints under the concrete floors the sedimentation tanks. The bed is really in two stories, t broken stone base, the gravel and the eighteen inches of sa above being repeated. This allows the air ducts to be placed b at the bottom of the entire bed and about the middle of the b where the broken stone layer is repeated. No informatio available as to the efficiency of this plant, the engineers in char being apparently unwilling to express themselves as to the e ciency. The plant was visited by one of the engineers of t Department in the spring of 1907, and again in August, 190 and at both times the filters were not running, the tank efflue being discharged directly through a dredged or dug channel in the waters of the sound.

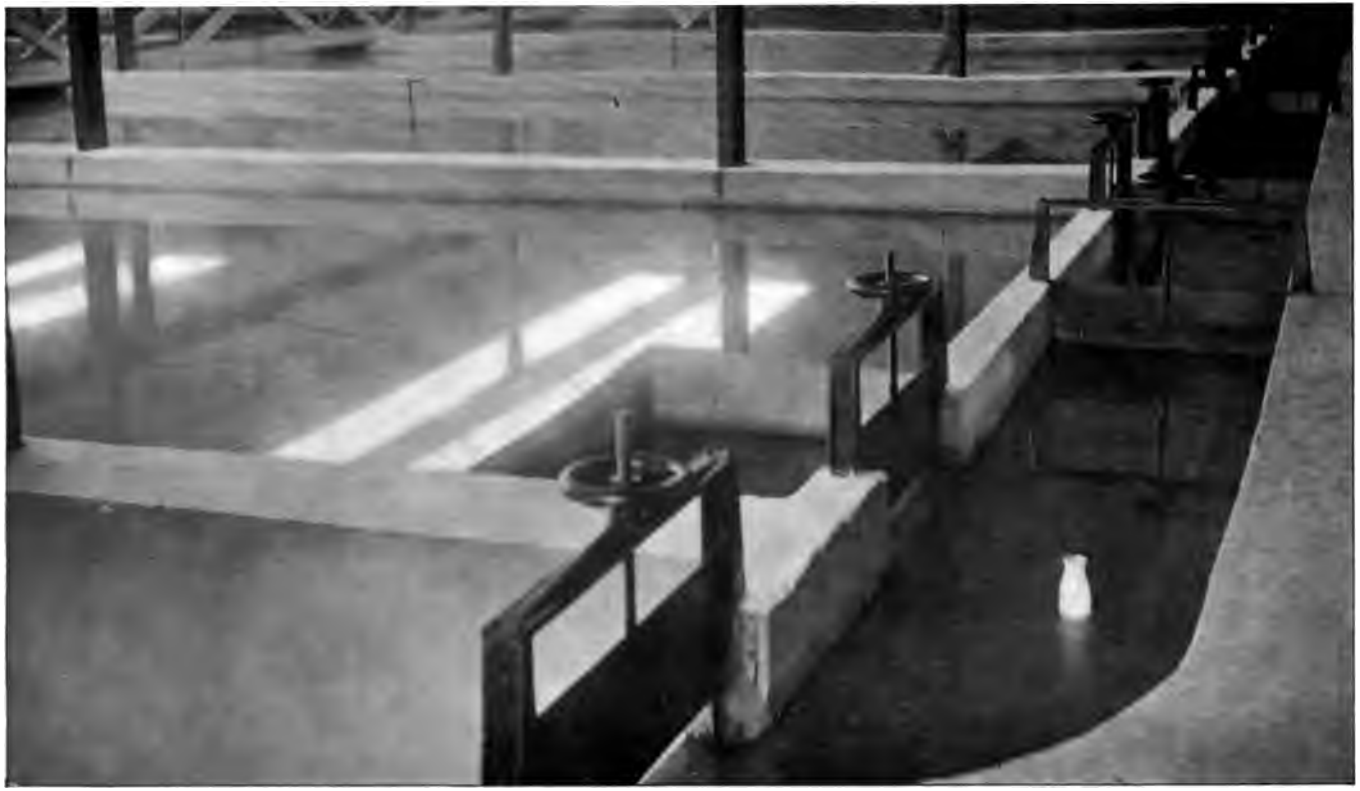
The illustrations show first, a general view of the boiler-hou and tank building from the outside; second, an interior view the sedimentation tankroom and particularly the inlet chann and third, a view of the filter beds.

FAIR HAVEN

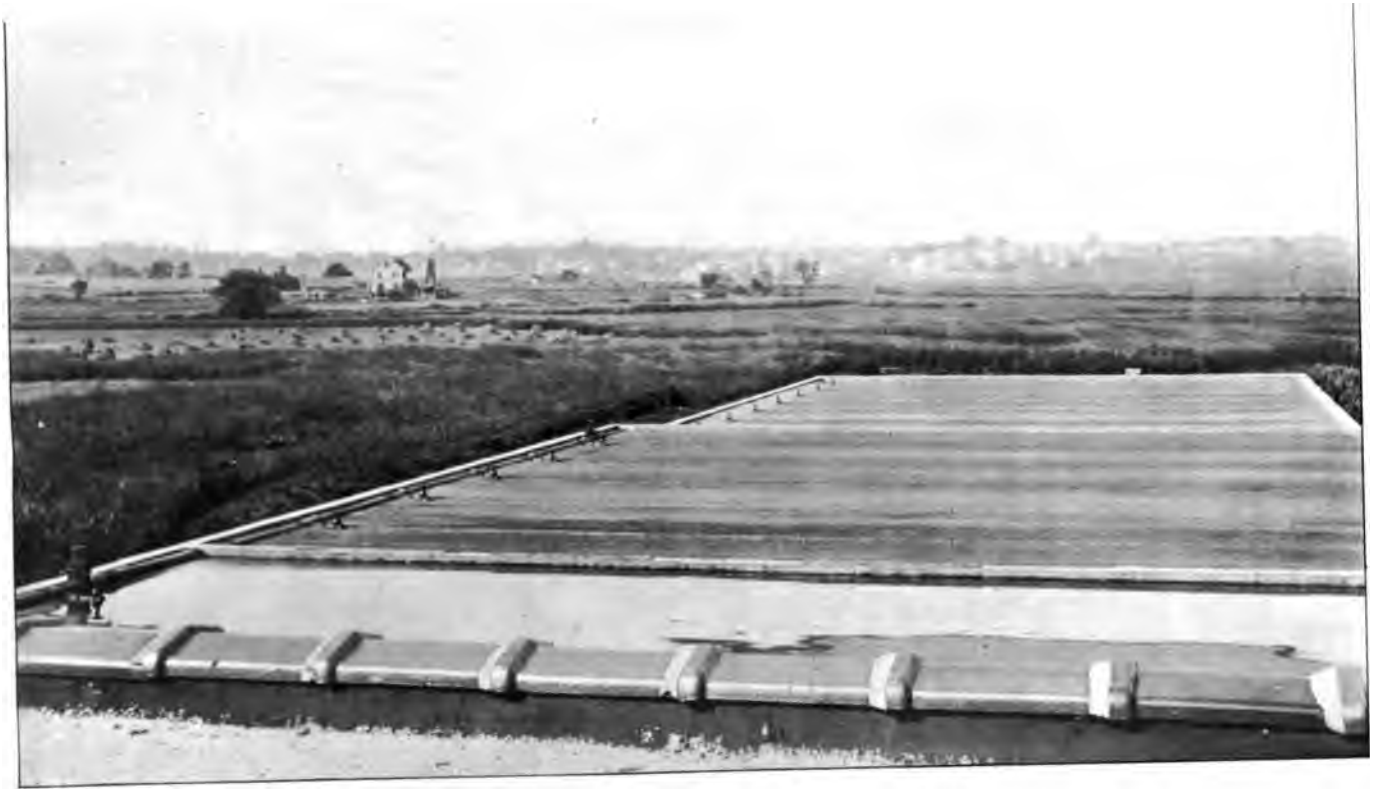
Located at the southern end of Skaneateles lake, and direc opposite Glen Haven, is a community of from 50 to 100 peo which is called Fair Haven. The hotel at this place is maintain only for its bar and the average daily attendance is small. meals are served and no effort is made to keep lodgers.

The water supply, like that at Glen Haven, is obtained fr springs on the hillside, the hotel being located at the base of hill and at the water's edge. The spring water runs freely at times and water is taken from the running streams as requir No measurement of the flow has been made. In its efforts maintain the purity of its water supply, Syracuse erected a d posal plant at this place which is to purify only the sewage fr the hotel. Privies are used at the homes of the other inhabita of the community and the fecal matter is removed every wee

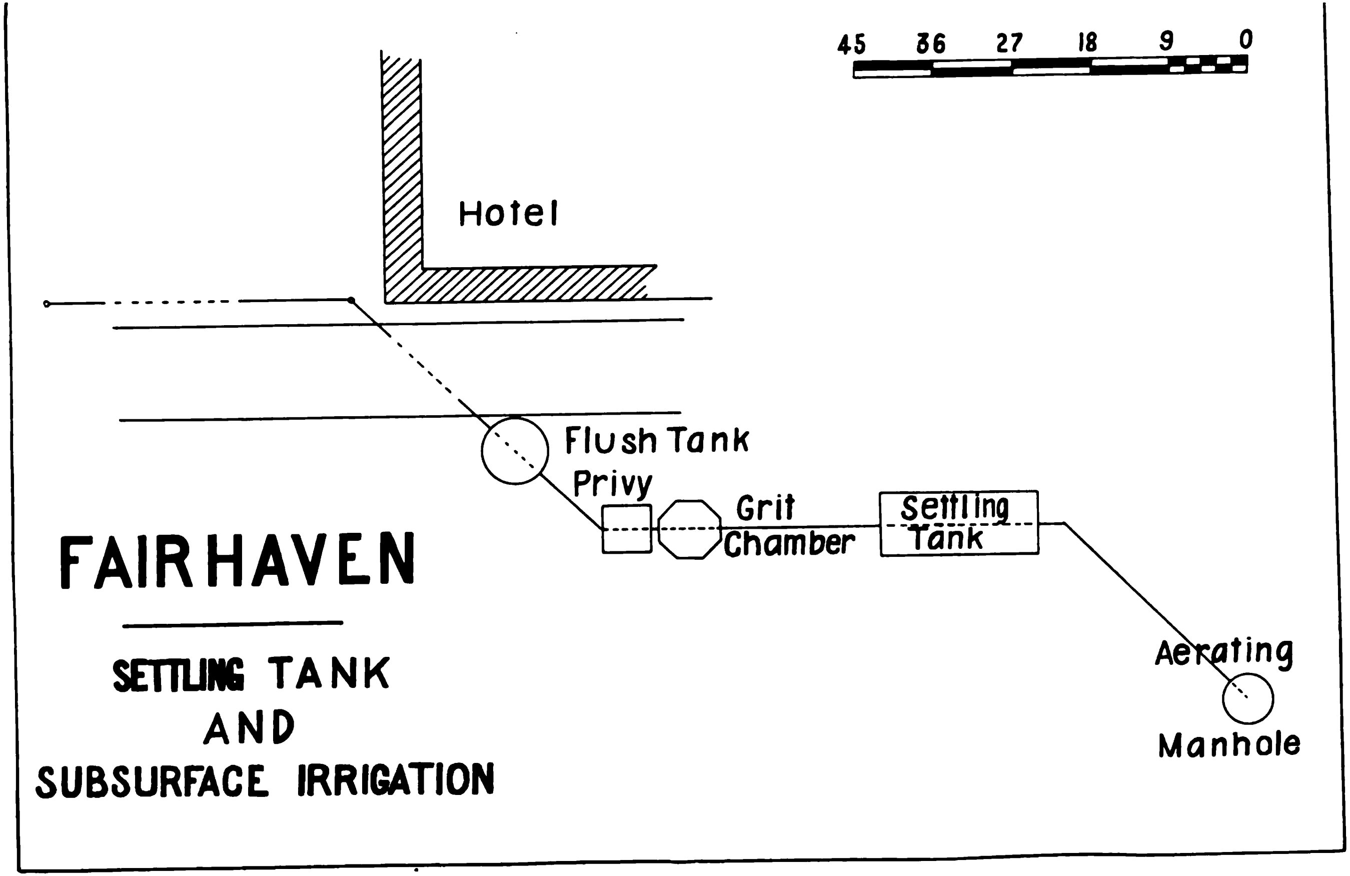
Elmhurst. General View.



Elmhurst. Sedimentation Chambers.



ELMHURST. FILTER BEDS.



FAIRHAVEN

SETTLING TANK
AND
SUBSURFACE IRRIGATION

he disposal plant at Fair Haven was built about a year ago
cares for the sewage of the Fair Haven hotel. The treatment
hardly be said to be more than a sedimentation followed by soil
ration.

t the rear of and at an elevation above the hotel was built a
vy vault. The privy is a small wooden four-feet by eight-feet
cture, built over a vault about two feet wide and running
m one end of the privy to the other under both of its com-
tments. Into this from a flush tank about fifteen feet away
containing an automatic siphon there is discharged, or was
harging on July 13, 1907, about eighty gallons of water every
een minutes. This water is taken from a miniature reservoir,
by a spring flowing down the side of the hill, at a point per-
s ten feet higher than the top of the flush tank and not more
n fifteen feet away; and flushes the sewage into a settling or
t chamber that is about ten feet distant from the privy vault.
is grit chamber appeared to be octagonal in plan with a diam-
r of about four feet. The sewage enters near the top of the
t chamber through a six-inch pipe and flows from it through
four-inch tile pipe on the opposite side of the chamber, the
ake of this outlet pipe being about six inches below the surface
the sewage in the grit chamber. Adjacent to the grit chamber,
l connected with it by the four-inch pipe placed in the wall
arating the two chambers, is the distributing tank. This tank
three feet square and contains a siphon discharging through a
e-inch pipe into a manhole fifteen feet distant in the bottom
which is built a concrete cone. The sewage enters at the base
the cone on one side of the manhole and leaves the manhole
rough a four-inch pipe placed on the other side of the cone.
he object of the cone may be to prevent a too ready flow of the
wage into the drain pipe and it may be to give greater oppor-
nity for aëration. After leaving this manhole the sewage flows
to about 175 feet of tile drain pipe from which it filters into
e surrounding soil. This pipe is from twenty to forty feet from
e water's edge and on that side of the road nearest the lake.
he soil is a mixture of clay and gravel and stone, not particu-
rly adapted for filtration.

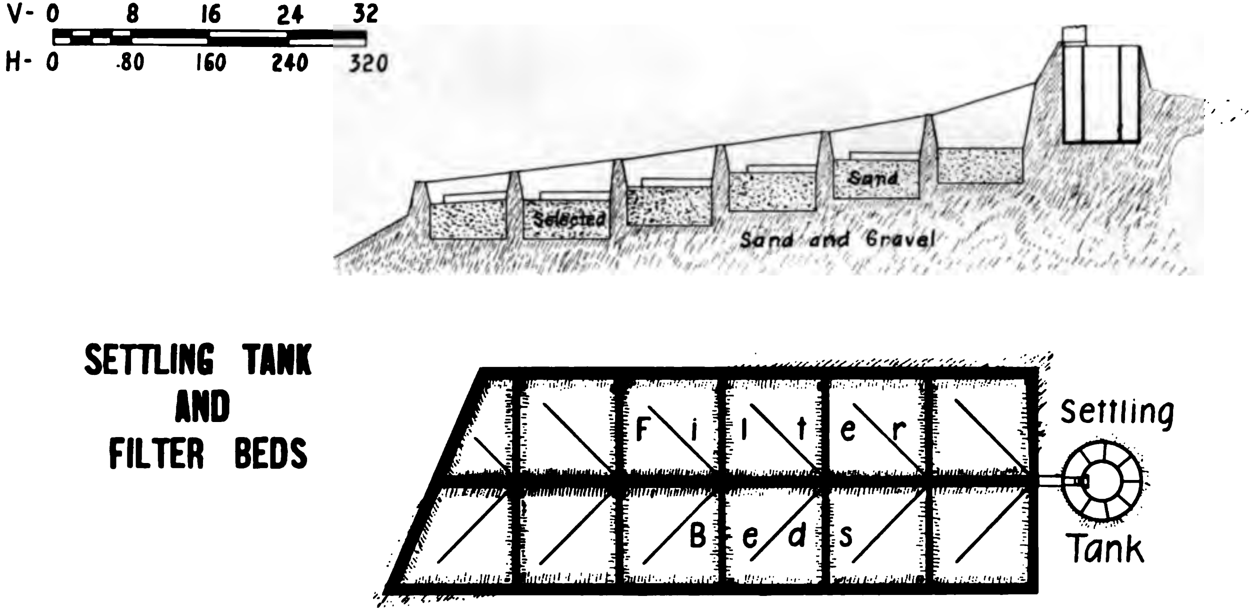
FAR ROCKAWAY

Far Rockaway is situated in the southern part of the boro of Queens and near the shore of Long Island sound.

The water is supplied by the Queens County Water Comp and is taken from wells having a diameter of six inches and ra ing in depth from 35 to 220 feet. The daily supply from t wells is about 2,400,000 gallons. The company has two sta pipes, one at Rockaway Park, 12 feet in diameter and 120 high, and one at Far Rockaway, 20 feet in diameter and feet high. There are ninety-seven miles of pipe in the distri ing system, the pipe ranging in diameter from four in to twenty inches, and to this system 3,785 connections have b made. The water is filtered before being used and passes thro one of two beds, one of which has an area of 20,000 square while the other has an area of 23,000 square feet. The filter material has a depth of four and five-tenths feet, there being th feet of fine sand, six inches of coarse sand and one foot of co gravel. The system was installed in 1885.

The sewage disposal plant, which is of the chemical precipitat type, has been in operation for eleven years, was designed J. J. Powers, and is similar in construction to the plant Jamaica or Ozone Park, but has four instead of six chambers each of the two series of chambers. The sewerage system i combined system. To carry the sewage to the plant it has b found necessary to build three ejector plants in each of which been placed two ejectors.

The sewage at first enters a well having a diameter of twe feet, and accumulates to a depth of about twenty feet. Fr this well it is pumped into the plant at the rate of 1,280,000 g lons daily. The sewage is screened at the receiving well. T well was cleaned in 1906 and again in May, 1907. At the ti of the first cleaning the well was half full of detritus and the time of last cleaning the well contained a depth of about feet of sand. This solid matter was deposited with the sludge depressions near the plant. As the sewage enters the plant stream of lime water is mingled with it and this is thorough mixed with the sewage as it flows through the four chamb



SETTLING TANK
AND
FILTER BEDS

GARDEN CITY

which have a combined length of 300 feet. In its passage through the plant the sewage passes through two screens, under two dipboards and over a weir. Sludge accumulates to a depth of nearly three feet during a period of two weeks. During the winter months the channels are cleaned once in four weeks instead of once in two weeks. Two days prior to cleaning the chambers the disinfectant made by using eighty pounds each of manganese dioxide, common salt and vitriol is allowed to be passed into the sewage for two hours. For the past six years the sludge removed from the chambers has been deposited in depressions near the plant. The sewage empties into Jamaica bay about 300 feet from the plant.

Samples of the effluent taken at the weir in the outlet channel showed a loss of the methylene color in fifty-two hours, and were clouded with flocculent masses.

GARDEN CITY[1]

Garden City is an incorporated city situated in the town of Hempstead, Nassau county, laid out and managed by a private corporation, The Garden City Company.

The property belonging to the company is divided naturally into five sewer areas or valleys running approximately north and south across the property and which would naturally collect all the drainage at the southerly boundary at five different points. Three of these control some eight or nine-tenths of the sewage, and one, the Cherry Valley, drains almost all the present town and provides for growth to the west for a mile or so. From these points the sewage is pumped by automatic centrifugal pumps electrically connected to the disposal plant, which is on a knoll near the southerly boundary line just west of the Cherry Valley road. The tank is peculiar in being circular in two concentric circles, the sewage entering the outside ring and passing through the eight divisions and into the inner circular space, from which it is discharged onto the beds. These beds are twelve in number, are artificial, filled with selected sand from the vicinity. The distribution on the beds is effected by means of a system phons which discharge regularly on bed after bed in successi

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[1] Condensed from the report of C. W. Leavitt.

GLEN HAVEN

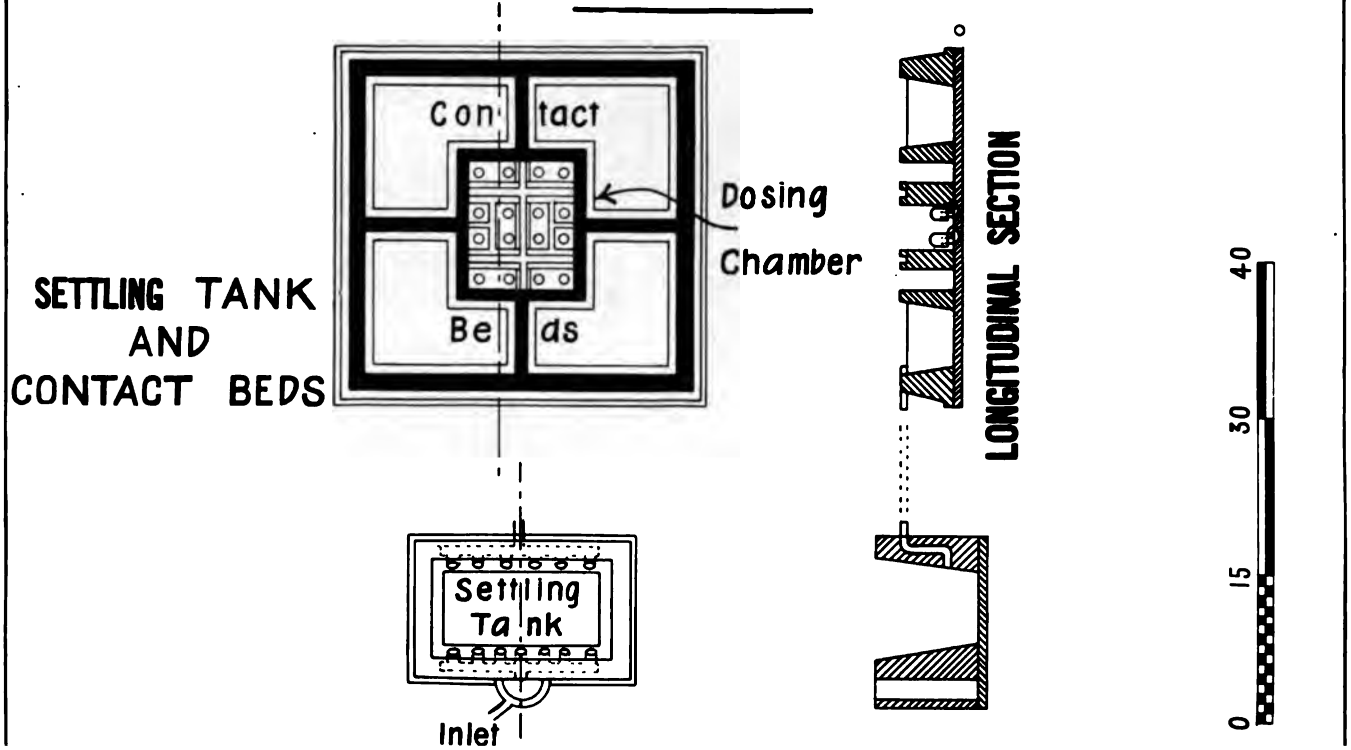
Glen Haven is a summer resort located at the southern tremity of Skaneateles lake. There are at this place nine cotta and the Glen Haven Hotel all being under the managemen the hotel. During three months of the year, from June 15th September 15th, the population ranges anywhere from ten fifteen to 250, but during the remainder of the year there is one at the place.

The water supply is obtained from springs on the hill b of the hotel, a wooded hill which rises almost abruptly from water's edge to a height of over 400 feet and from which abundant water supply is obtained. This is piped into the b and cottages and to the drinking fountains in the park. measurements of the quantity of water available have been n and a large part of the present supply is wasted.

The city of Syracuse draws its water supply from Skaneat lake, and to protect the purity of its supply it has undertaken construction of a sedimentation tank and of contact beds for purification of the Glen Haven sewage. At the present time, 13, 1907, the excavation is being rushed but it does not probable that the plant will be in operation before the co season.

As at present designed the sewage is to collect in about 1 feet of sewer pipe through which it will flow by gravity pumping chamber. From this pumping chamber it will through about thirty feet of pipe to a settling tank, eighteen one-half feet long and ten feet wide. It will enter this through seven T's, discharging three feet above the bottom of tank, and leave through six T's whose intake ends are also t feet above the bottom of the tank. These six T's, however, lea an eight-inch overflow pipe, within which is placed a four-i outlet pipe discharging at a level four feet above the lev which the sewage enters the tank.

GLEN HAVEN


Con tact
Be ds
Dosing Chamber
SETTLING TANK
AND
CONTACT BEDS
Settling Tank
Inlet
LONGITUDINAL SECTION
0
15
30
40

From this tank the sewage flows into the dosing tank. This dosing tank is thirteen feet by fifteen feet and is surrounded by the four contact beds, so laid out that they form a rectangle thirty-three feet nine inches by thirty-five feet two inches. In the dosing tank will be placed eight automatic time siphons which will regulate the flow upon the beds and the discharge from he same.

The contact beds are to be built adjacent to the septic tank and are to be filled with crushed stone to a depth of a few feet. In the bottom of each bed will be laid ten feet of six-inch underdrains and nearly thirty feet of four-inch lateral underdrains.

From the contact beds the sewage will flow through an eight-nch pipe directly into the lake from which the proposed location f the plant is about 250 feet.

The sewage may be turned directly into the discharge pipe allowing the settling tank to be cleaned, or it may be passed through he settling tank and emptied into the discharge pipe without passing through the contact beds.

Mr. Allen, city engineer of Syracuse, is engineer of contruction.

HUDSON SCHOOL

The Hudson School for Girls is a State institution located at Hudson, N. Y., and is situated on the east bank of the Hudson and on a hill overlooking the river.

The water supply of the school is delivered by the municipality of Hudson and is taken from Taghkanic creek, some twelve miles from the city. After passing through seven miles of twelve-inch and sixteen-inch pipe, the water enters an 80,000,000 gallon reservoir. Near the city the water passes through one-half acre of filtering area having a depth of nearly 3.5 feet of sand, gravel and stone. From this filter the water passes into two reservoirs, one having a capacity of 3,500,000 gallons and the other 679,000 gallons, and from these reservoirs it is supplied to the city of Hudson and to the school. An average of 26,413 gallons of water is used daily by the school, this being slightly less

than seventy-one gallons per head per day. Sixteen buildin
longing to the school are supplied with water through abou
feet of pipe. Water has been taken from this source since 1
by the city of Hudson and since 1887 by the school.

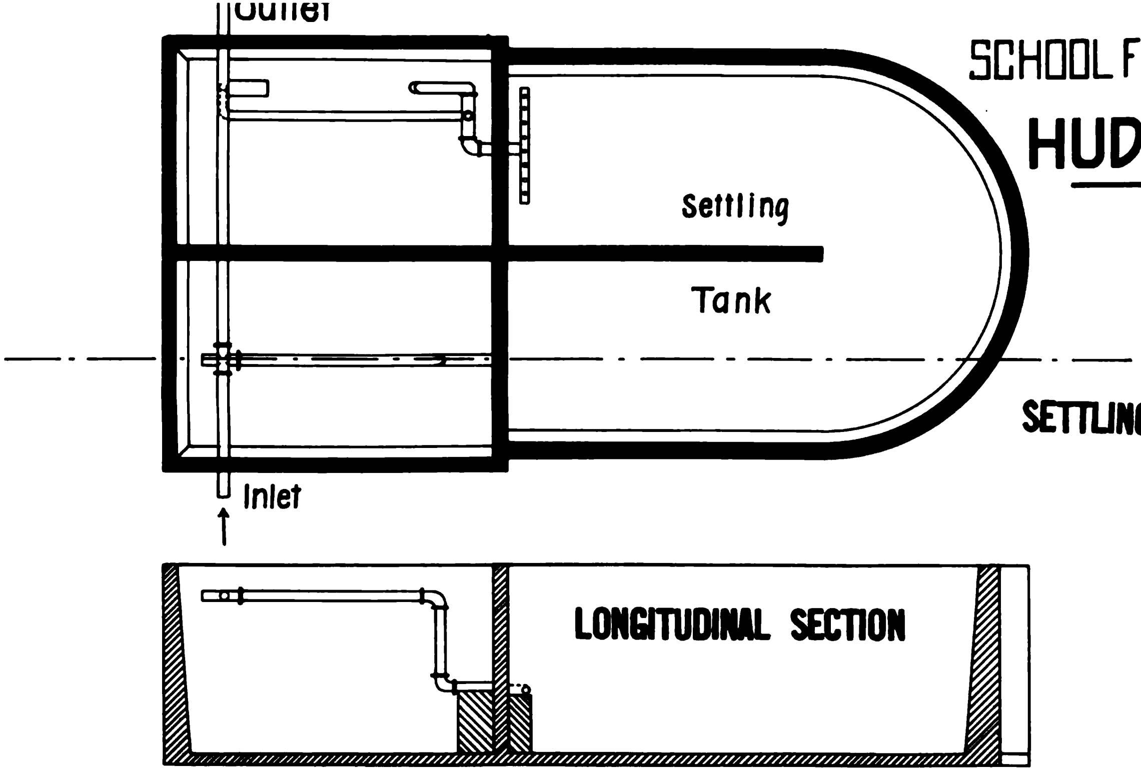
A sewerage system having a length of about 3,300 feet was
in 1887 to carry the sewage to the river. In December, 19
new sewerage system and settling tank were put into oper
and the old system was converted into a storm water system.
new system has a length of about 4,800 feet and is made up o
eight and ten-inch vitrified tile pipe, half of which is eight
pipe. The population connected with the system is 374 pe
311 inmates, fifty women officers and thirteen men to car
grounds.

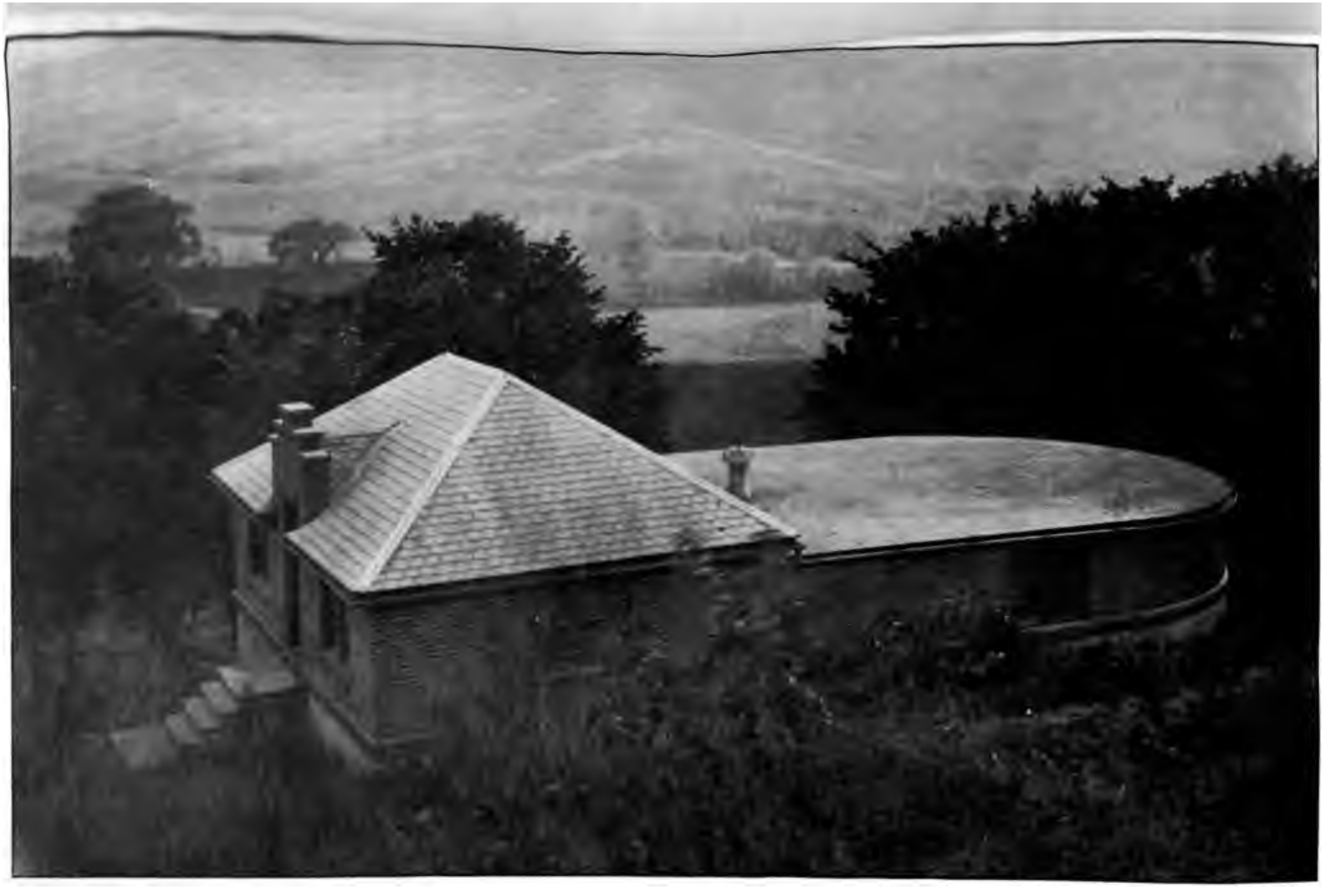
The purely domestic sewage enters the settling tank th
an eight-inch pipe in which, in the inlet chamber, has been
two valves, one regulating the flow of sewage through the
the other diverting the flow from the tank to the discharge
This discharge pipe is nine feet ten inches above the inlet ch
bottom but enters the chamber at a point 4.33 feet above th
tom of the chamber and four feet eleven inches below the s
of the sewage when the surface level is at its highest point. I
passes along and from one side of the chamber to the oth
average distance of fifty-two feet. At the outlet end of the
ber the sewage enters a six-inch horizontal pipe, ten feet
4.25 feet above the bottom of the chamber, and perforate
two-inch holes spaced one foot apart. From this pipe the e
may reach the discharge pipe through one of two ways; a
inch swiveled pipe having a length of six feet, or a rigid si
pipe. The four-inch swiveled pipe is, or evidently was, int
for use only in cleaning the chamber and by means of it th
face level of the sewage in the septic chamber may be
from four feet three inches to nine feet three inches. O
day of inspection, August 29, the depth of sewage was abou
feet. From the open end of this swiveled pipe the sewage
into an open semi-cylindrical cast iron trough about twelve i
in diameter and four feet two inches above the floor of the
chamber. This trough is connected with the rigid six-inch
let pipe and discharges the effluent into the eight-inch pi
tended for that purpose. When the swiveled pipe is in a

SCHOOL FOR GIRLS

HUDSON

SETTLING TANK





Hudson School for Girls. Settling Tank.

tical position discharge takes place through the rigid six-inch e. In discharging through this pipe the sewage rises through feet of pipe, flows horizontally through some ten feet more then drops nine feet three inches, discharging into the effluent e through the same pipe through which discharge from the t iron trough takes place. Once in this eight-inch vitrified tile ent pipe the effluent flows across the school property and emp- s into the Hudson river 630 feet from the fence on the west e of the school property.

The discharging end of the effluent pipe is below the water sur- e about nine inches at low tide. As samples of the effluent uld not be obtained at this point they were taken from the iveled pipe in the outlet chamber. These samples indicated a trescible effluent in 14.5 hours, but this should not be considered normal, as only a very small fractional part of the sewage was wing through the tank at the time. The effluent was slightly rbid and had but a slight odor.

Provision for cleaning the chamber, the inlet and outlet cham- rs has been made by laying six-inch pipe in the beds of the ambers, leading to a six-inch vitrified pipe outside of the build- g. About 300 feet from the tank this sludge pipe terminates, discharging end being imbedded in a masonry retaining wall d at such an elevation above the surface of the soil as to allow vagon to be driven beneath it. A gate valve placed at the dis- rging end enables one to cut off the flow of sludge at any time l makes it possible to remove the sludge in wagon loads without adling the same.

Provision has also been made for running the effluent from the nber upon contact beds as soon as the same shall be built.

The chamber has not been cleaned since it was put into com- ssion and at present there cannot be more than three inches of iment on the bottom of the chamber. This again is un- btedly due to the fractional flow that was passing through the nber for a period the length of which no one seems to know. e surface scum was about six inches thick.

The sewer system now used as a storm system cost about $1,250 l the new sewer system and settling tank together cost $6,- l 45.

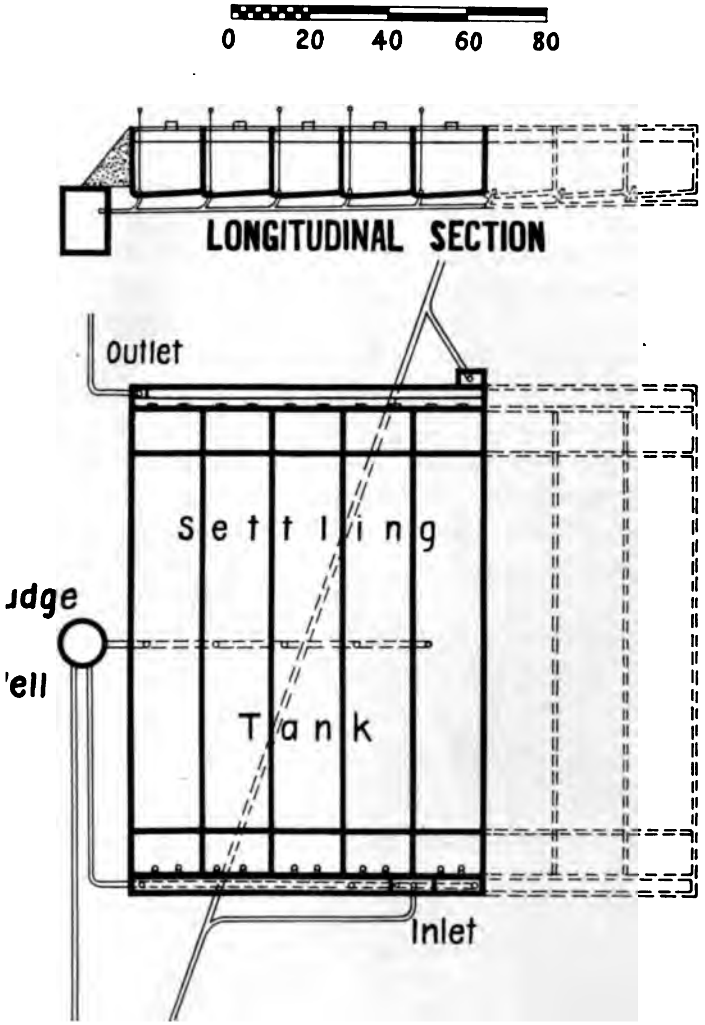
So little care or attention has been given the plant that t of operation has practically been nothing.

The illustration shows the exterior of the building ove sedimentation tank.

ITHACA

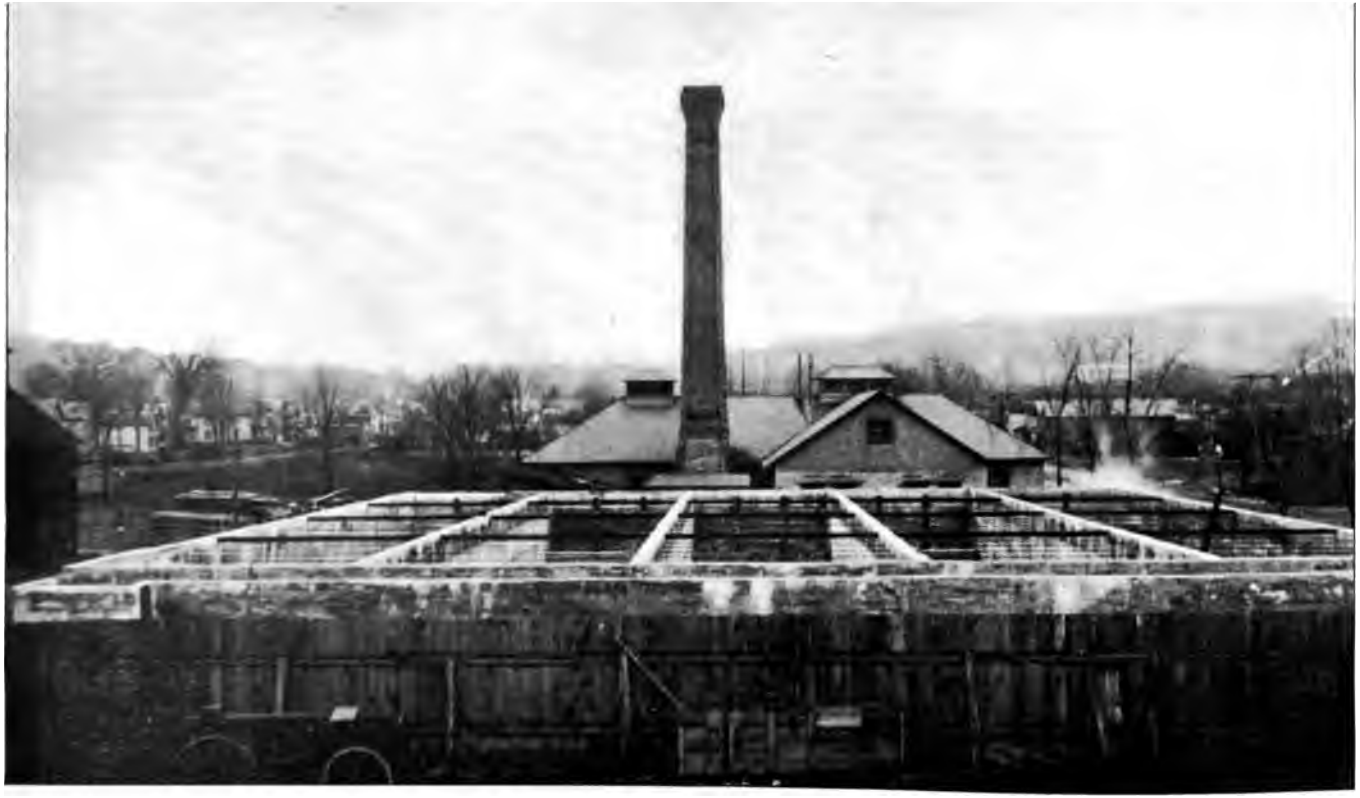
The city of Ithaca lies partly on an alluvian deposit at head of Cayuga lake, and partly on the three hills which surr the head of the lake. The highest point of the level portio the city is about twenty-five feet above mean lake level, and center of the business portion is about a mile distant from lake. Cornell University, with its many buildings, and 4 students, lies on the east of the town and about 400 feet abo South and west hills are less thickly populated, but a consider population is gradually encroaching on their slopes. A sepa system of sewers has been in operation since 1894, the sew being all received in a receiving well on the northern edg the built-up portion of the city, the bottom of the lake being a ten feet below mean lake level. Two auxiliary pumping sta are necessary to carry the sewage from the southern portio the village to this well. The average daily flow is found to from a minimum of 1,000,000 gallons per day to a maximu about 4,000,000, the rise and fall of the ground water in the vian soil and the corresponding amount of infiltration bei sponsible for this difference.

When the sewers were built in 1894, disposal was had by ing the sewage from the receiving well through 10,700 fourteen-inch cast iron pipe into the lake at a point wh gradually increasing depth of water had reached thirt This point was about one mile off shore. Owing to the gr the city, the capacity of this outfall pipe and the capacity pumps has been overtaxed, in time of high ground wat fact, at times it has not been possible to handle the flow portion of the sewage has been diverted through outlets i streams which surround the city. The chief of these outl been at the pumping station where a fourteen-inch outl tapped, and a portion of the flow diverted at times into the

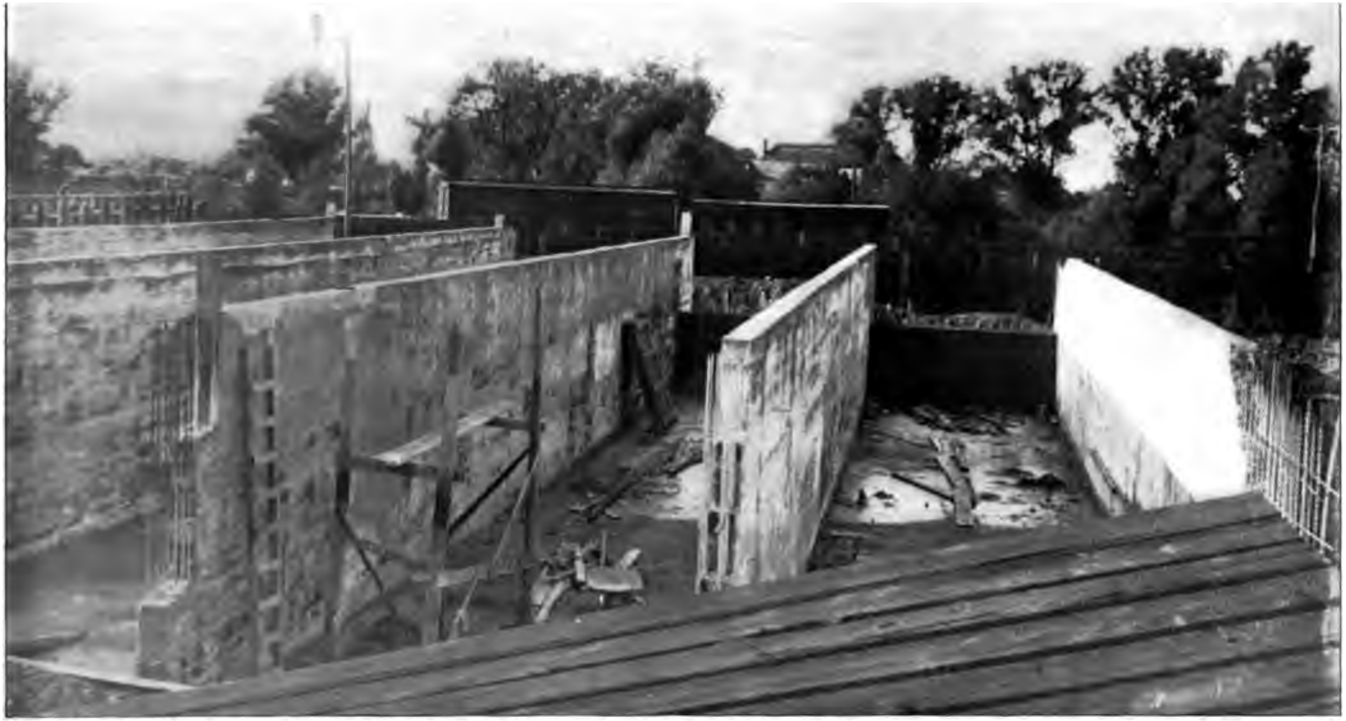


ITHACA

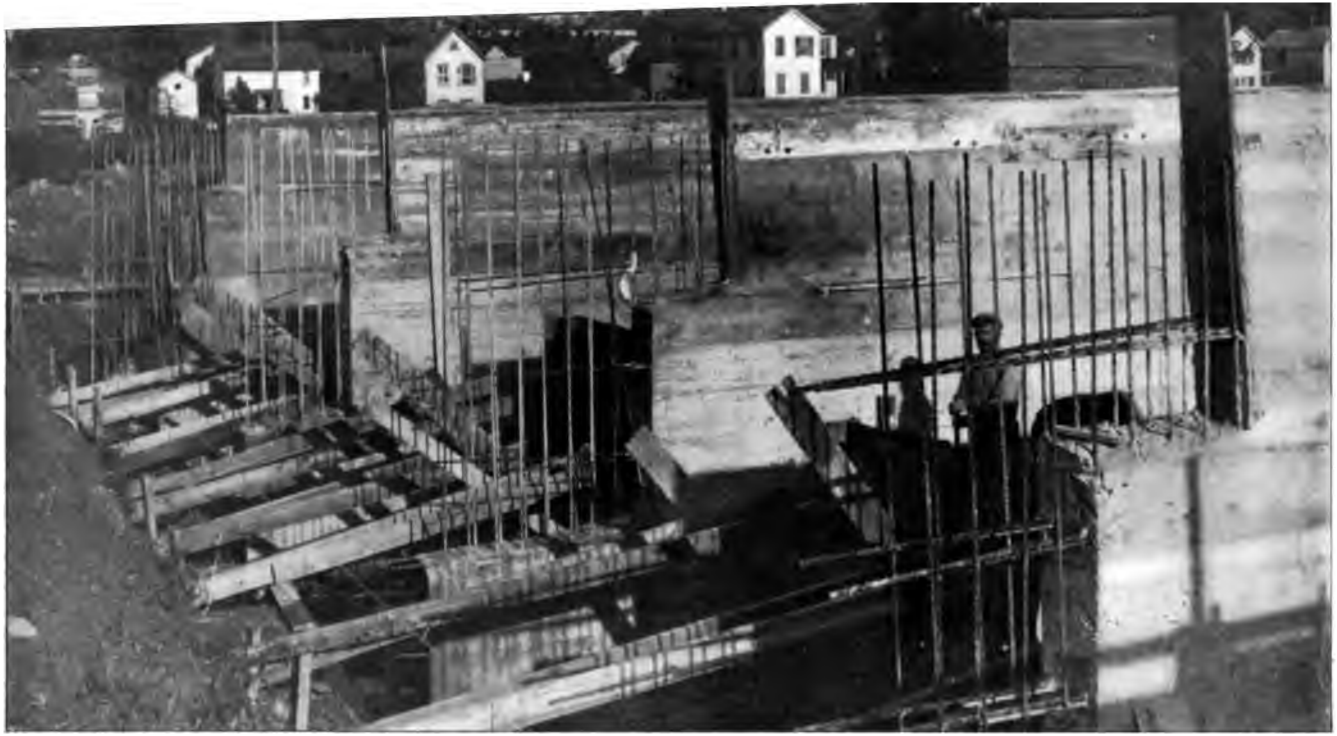
SETTLING TANK



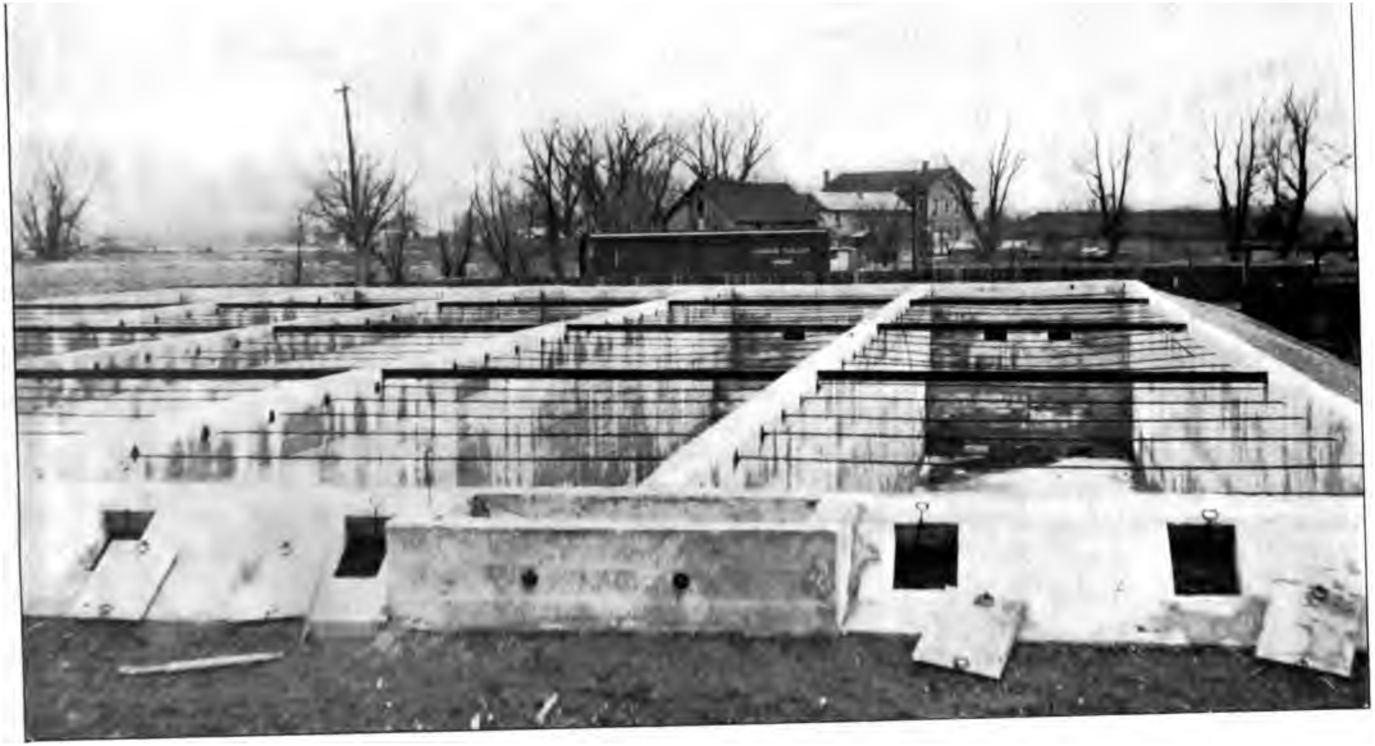
Ithaca. Settling Tank, Looking from Outlet to Inlet End.



Ithaca. Settling Tank, View from Inlet to Outlet.



Ithaca. Settling Tank Showing Reinforcement.



ITHACA. SETTLING TANK.

To relieve the attendant of work at the pumping station
› economize in fuel, this outlet has been used more often
ıas been necessary, and large deposits of sewage mud have
l as a consequence at the end of the outlet pipe. Loud com-
s have been made of this condition, both on account of the
ion of the banks and stream as well as on account of the in-
acy of the disposal pipe. Within the past year sedimenta-
anks have been built on the grounds adjoining the pumping
ı from which discharge is made into the nearby inlet at a
where a greater current is formed than heretofore. These
five in number, are each 124 feet long, 17 feet wide,
.2 feet deep, below the water line, containing in all about
00 gallons. The fourteen-inch line has not been removed,
ıt by an arrangement of valves it is possible to pump with
pressures into the tanks and lake, or into either separately.
verflow is provided at the outlet end of the tanks into the
en-inch pipe, the head in the tanks allowing about 1,000,000
s per day to flow into the lake if desired. The sewage is
ed from a Y branch out of the fourteen-inch pipe through an
riser in the middle of a concrete well three feet wide and
feet long. From each end of this well the sewage flows
. channel three feet by three feet, which extends the entire
. of the tank. Out of this channel open ten flap valves, two
ach tank, leading by T's and straight pipe of six-inch
cotta to the submerged inlets six feet above the bottom.
crete baffle wall ten feet from the inlet prevents any forma-
f current. A similar baffle wall at the outlet end protects
ıtlet valves which are rectangular, twelve inches high by
-four inches long, protected on the outside by flat valves.
nnel similar to the one already described extends along the
e of the tanks at the outlet end, and a weir on the outer
f this channel preserves the desired level of the water in the

The overflow from the wall is in a channel two feet wide,
end of which is a vertical eighteen-inch cast iron pipe which
s off the sewage into the stream. The walls of the tanks are
›ot thick, heavily reinforced with one-half-inch Ransome
paced seven inches vertically and twenty-four inches hori-
ly. The tops of these walls are held from spreading by one-
on rods spaced five feet apart and against the pressure of the

bank by five-inch I beams thirty feet apart. The channels at two ends are supported on brackets and tied in at the inlet by panded metal which forms a roof to the channel. Sludge va are provided on the bottom of each tank at each end of the i channel, and in the grit chamber leading by pipes to a sludge just outside the tanks. The sludge pump has not yet been stalled, but it is proposed to pump the sludge at proper inter onto beds in the vicinity which can be kept covered with a from the pumphouse. The elevations have been carefully sidered with reference to the future construction of filter bed a selected locality provided such further purification is f necessary. The original design of the sewage system was pla by Rudolph Hering, assisted by J. H. Fuertes, and the plans the tanks were made by Williams & Whitman, of New York

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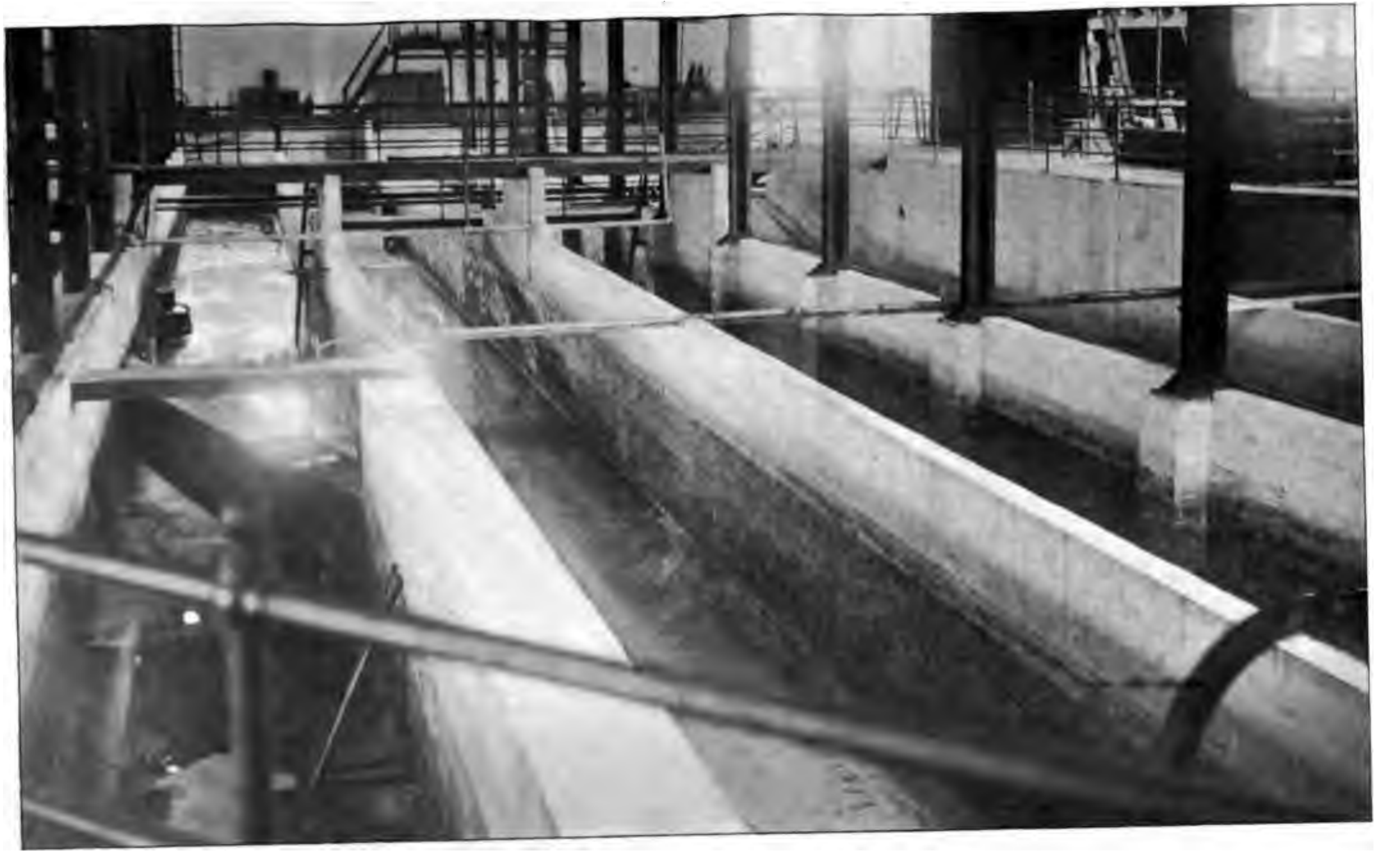
JAMAICA

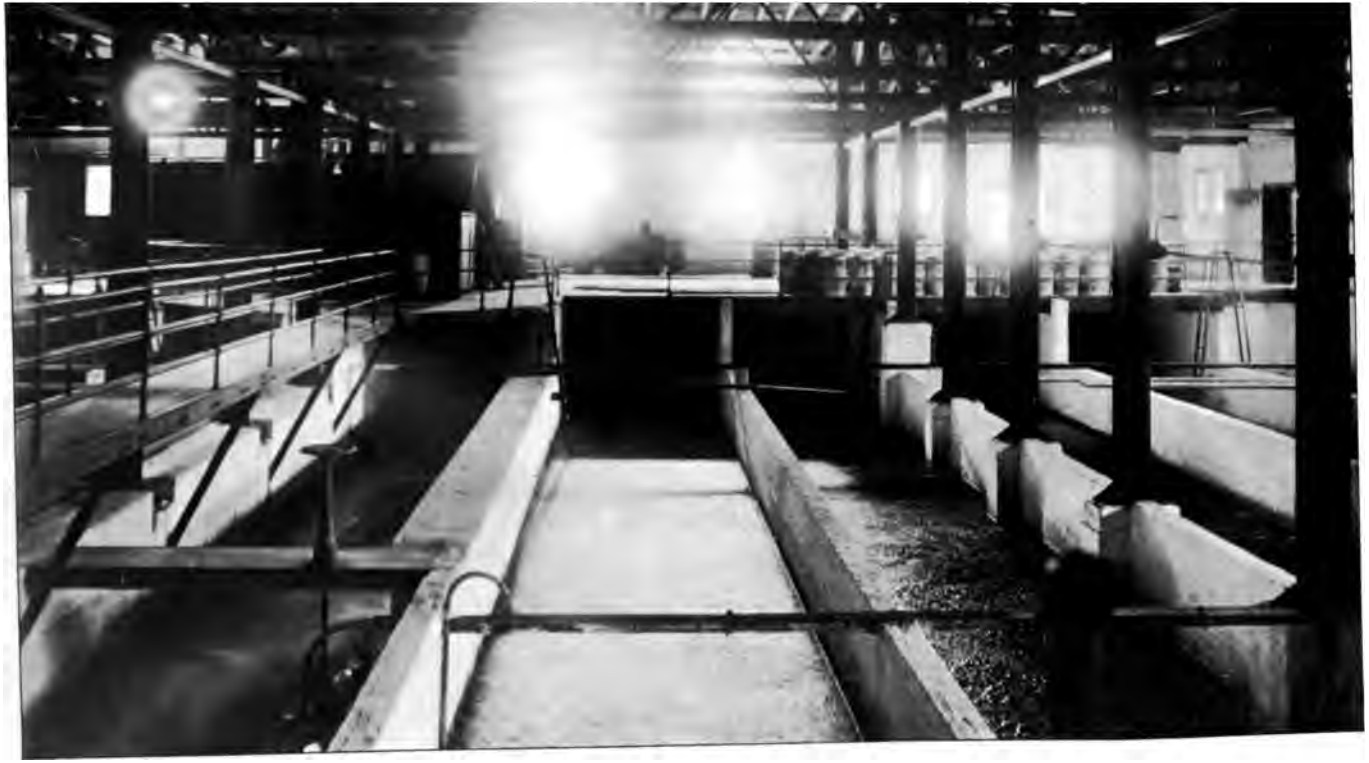
The Jamaica Bay Disposal Plant is located in that part of borough of Queens known as Ozone Park and about one from Jamaica bay.

The water supply, which is furnished by the Jamaica W Supply Company, is taken from twenty six-inch and eight- wells, having a depth of sixty feet, and located about a from the city. The water is carried by direct pressure in standpipe at Jamaica having a capacity of 400,000 gallons.

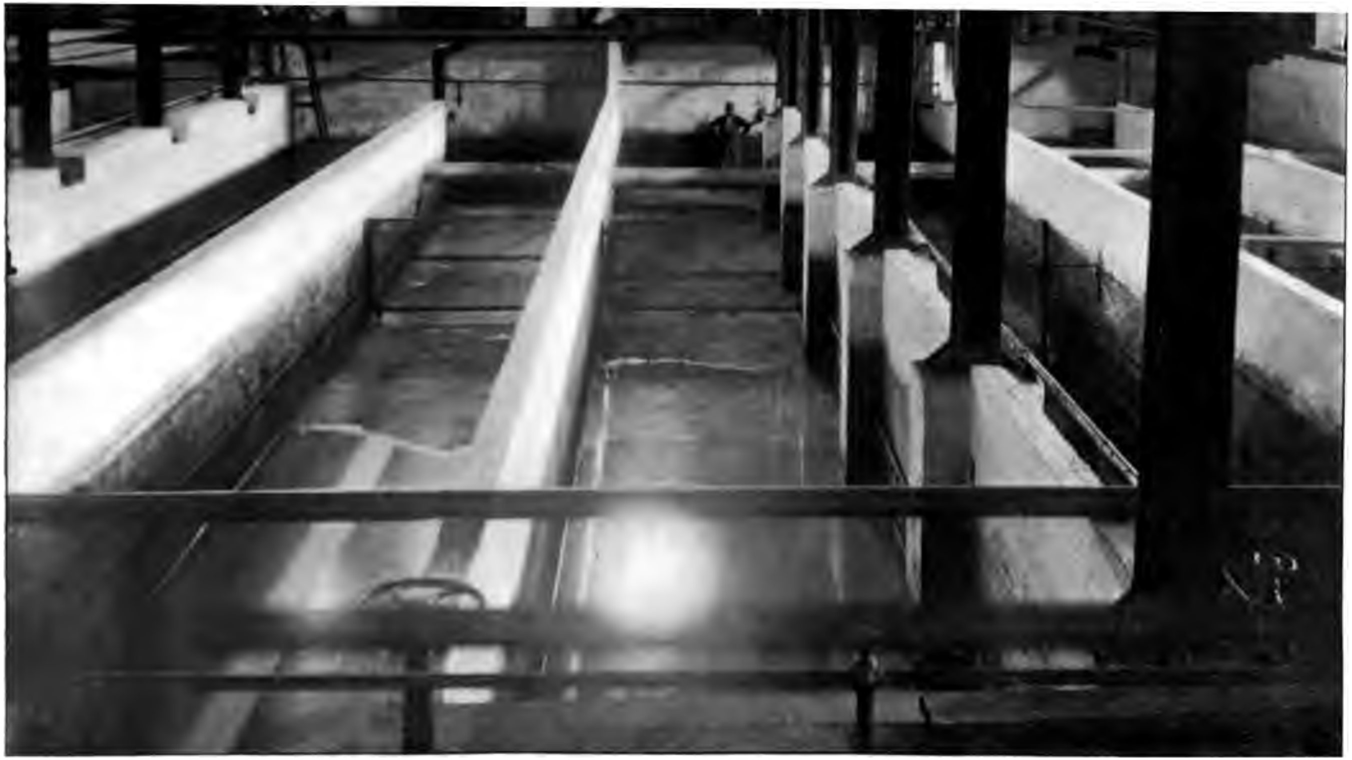
Unfortunately it has not been possible to obtain desired formation concerning the sewage disposal plants in the bor of Queens from those in authority, and the following descrip will be largely the result of a short personal inspection of plant, supplemented by such information as those in charge a plant were able and felt free to give. The plant, which is of chemical precipitation type, was designed by J. J. Powers was put in operation in March, 1903. It has a capacit 10,000,000 gallons and cares for the sewage of a populatio about 25,000. The sewerage system is made up in part of sets of chambers having a total width of 125 feet and a lengt 250 feet, and about two-tenths mile of brick effluent sewer.



JAMAICA. VIEW FROM WEST END, LOOKING EASTWARD AND ACROSS BRIDGE.



Jamaica. View from Bridge, Looking Westward. Chambers Filled with Sewage.



JAMAICA. VIEW FROM BRIDGE, LOOKING EASTWARD. CHAMBERS CLEANED AND READY FOR USE.

The sewage, entering the plant through a brick sewer, passes hrough one of two thirty-six-inch gate-valves into one of the two eries of six sedimentation chambers. These chambers are about feet wide, 250 feet long, and about 7 feet deep, and re so placed that the sewage must traverse the entire length of ne before it can enter the other, and in its flow through the six hambers it traverses a distance of 1,500 feet. Near the outlet nd of the inner or sixth chamber of the series is a weir built iagonally across the nine-foot chamber and having a length of irty-two feet. After passing over this weir the sewage flows bout fifty feet before it enters the outlet brick sewer which leads rom the plant at the same end at which the sewage enters and ertically beneath the inlet sewer. The chambers slope from each nd toward the center and enable the sludge or other matter to e washed to one point for pumping.

Lime water is introduced into the sewage as it enters the plant, eing fed into the sewage in a steady stream. Every two or three eeks an insecticide is passed through the sewage, and once in ix weeks, prior to cleaning the sludge from a set of chambers, he chlorine generated from fifty pounds of sodium chloride, fifty ounds of manganese dioxide, and fifty pounds of vitriol is passed hrough the sludge.

The sludge, which is not used for any purpose, is pumped into n earth basin 6 feet deep, 40 feet wide, and 650 feet long. n its fresh state about forty tons of the sludge are removed each onth. The sewage empties into Jamaica bay, flowing two-tenths ile of two-foot brick sewer and eight-tenths mile of open channel. amples of the effluent taken at the outlet end of the outlet sewer howed a loss of the methylene color in less than twelve hours.

To operate the plant a force of about fourteen men is required. he chemicals used during the year are approximately: Lime, 00 to 900 barrels; perchlorate of iron, 5,000 pounds; NaCl, ,500 pounds; MnO_2, 1,500 pounds; vitriol, 1,500 pounds; in-ecticide, 700 gallons.

The illustrations show detail views of the interior of the build-ng and furnish a clear idea of the appearance of the sedimenta-ion tanks.

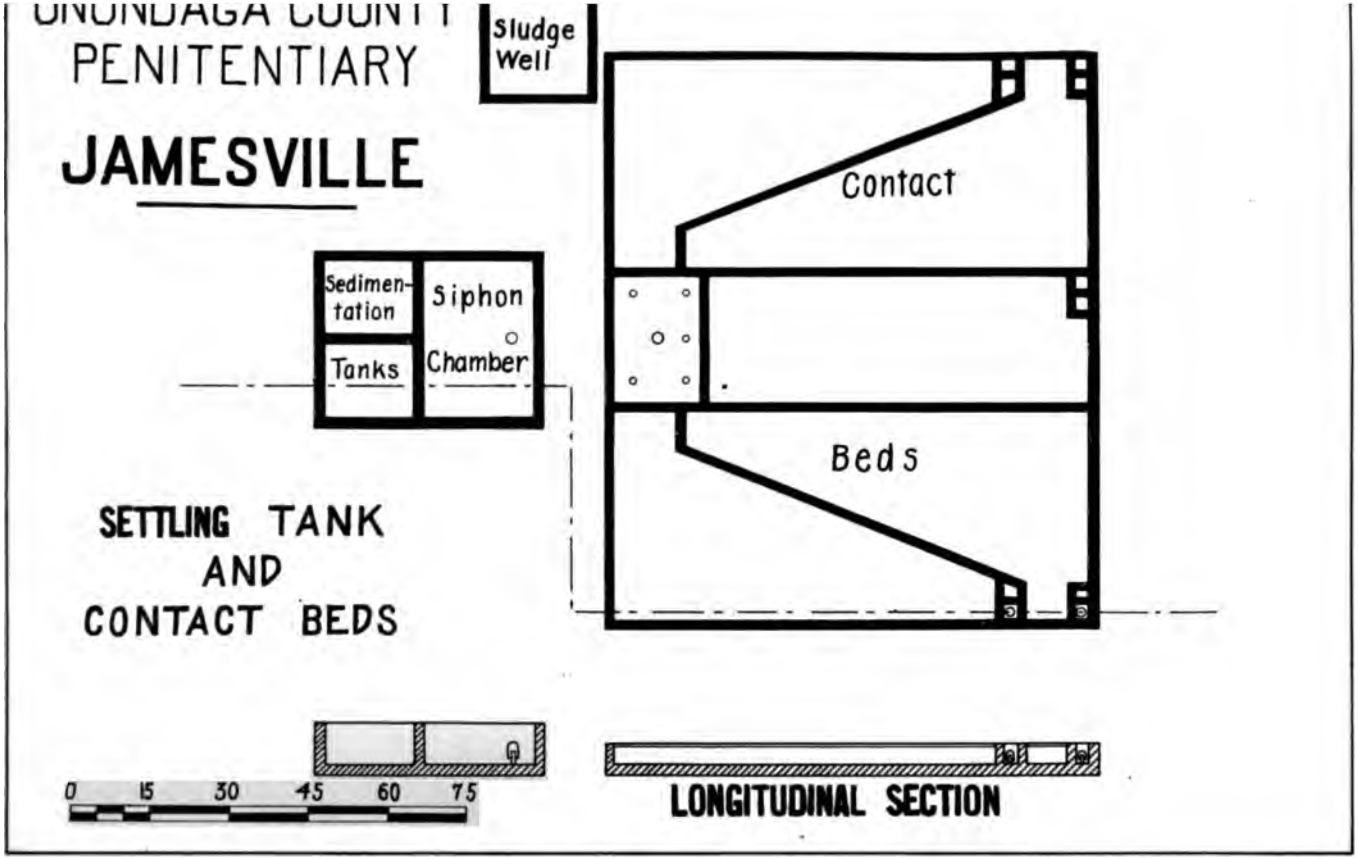
JAMESVILLE

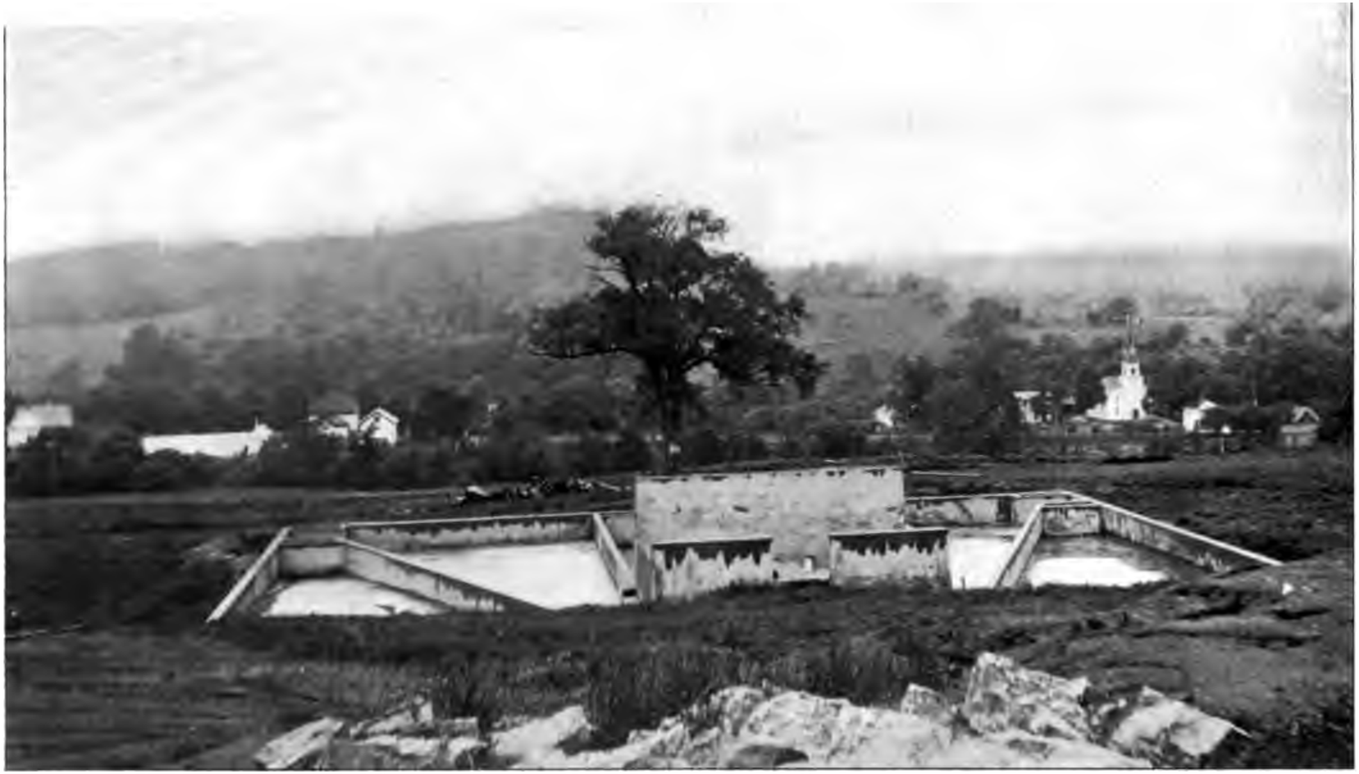
Situated about 500 feet above the city of Syracuse, at th waters of Butternut creek and in the village of Jamesville, Onondaga County Penitentiary. The village of Jamesvil a population of perhaps 300.

The water supply of the penitentiary is obtained from a at the foot of the hill, and is lifted by water power from] nut creek 232 feet into a standpipe twenty feet in diamet sixty feet high. One thousand eight hundred and fifty f pipe lead the water from the pump to the standpipe, and 60,000 gallons or 200 gallons per head per day (high) are pu The buildings are connected to the force main by a Y an feet of pipe take water from the pump, or from the reservoi the pump is not in operation. The supply is good having only when it was attempted to sink a shaft for a gypsum near the spring. At that time the mine workers were pu 800 gallons per minute from their shaft.

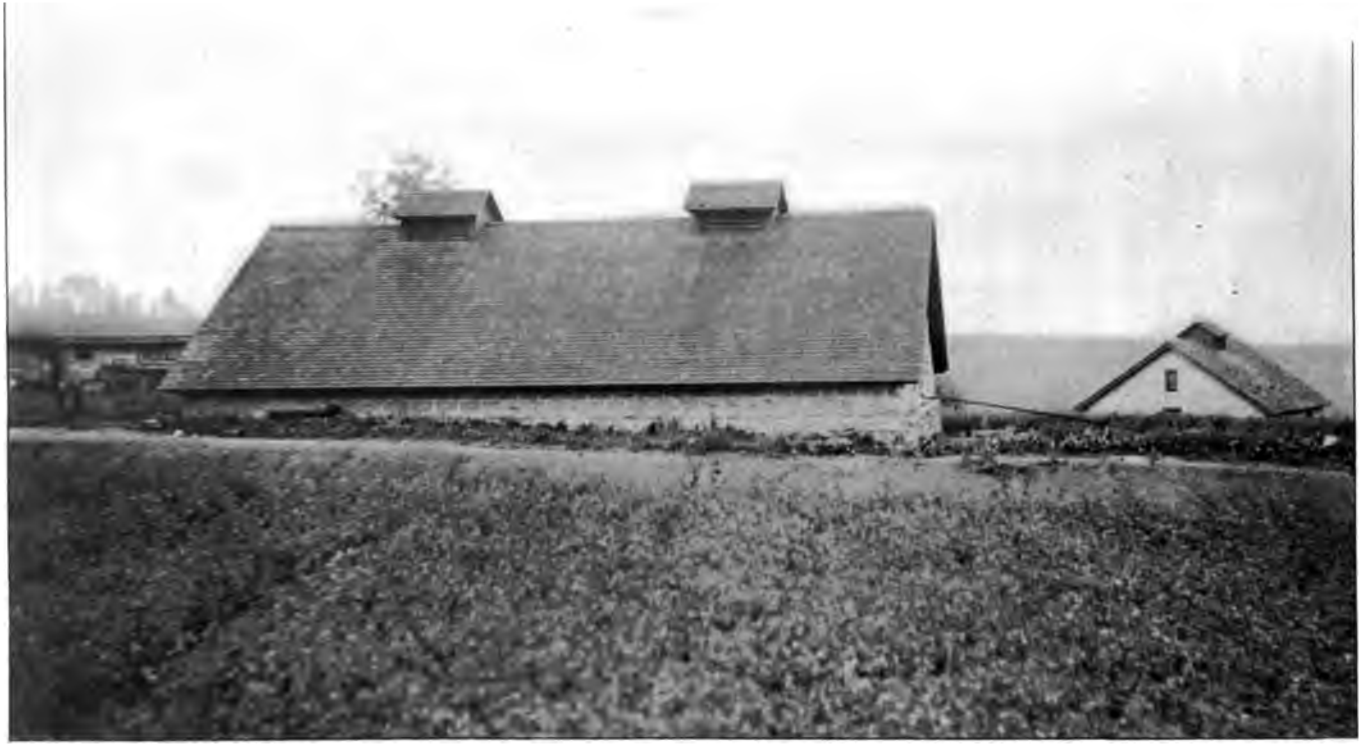
The sewerage system was built six years ago and the pla the settling tank and contact beds were approved by the Department of Health in November, 1904. The aut siphons for adjusting the flow to and from the contact bed not yet been installed nor have the contact beds been fille crushed stone. The plant is to care for the sewage from th tentiary, at which place the average attendance is 300. Abo feet of non-underdrained pipe have been laid by which the s is to be carried to the settling tank. The penitentiary is loca a limestone hill and the sewers are from three and one-half feet deep. There is no ground water entering the system.

The sewage at present enters two sedimentation tanks. were intended to be used alternately but are used continuo present, it being thought easier to keep them clean. From tanks it feeds into a siphon chamber which occupies the rem of the building. When the contact beds are put in opera is intended to remove the walls separating the two small rec tanks from the siphon chamber and to make a large tank three chambers. From this siphon chamber the effluent through about 1,000 feet of pipe into Butternut creek.

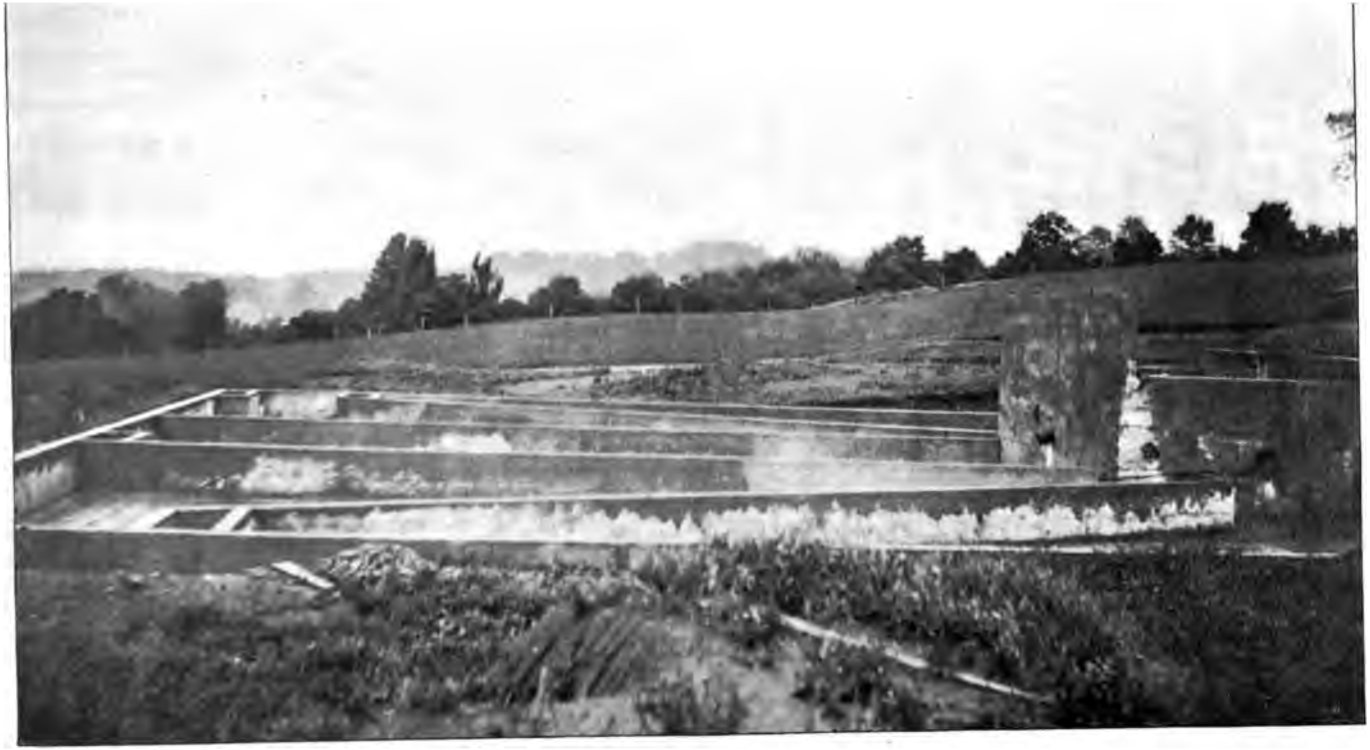

ONONDAGA COUNTY
PENITENTIARY
JAMESVILLE
Sludge Well
Sedimentation Tanks
Siphon Chamber
Contact Beds
SETTLING TANK AND CONTACT BEDS
0
15
30
45
60
75
LONGITUDINAL SECTION



JAMESVILLE. VIEW OF CONTACT BEDS, LOOKING FROM SETTLING CHAMBER.



JAMESVILLE. SETTLING CHAMBER IN FOREGROUND; SLUDGE CHAMBER IN BACKGROUND.



JAMESVILLE. SIDE VIEW OF CONTACT BEDS.

he contact beds are put in operation the effluent of the siphon chamber will flow about 250 feet into the receiving siphon chamber of the five contact beds. From these beds it will enter the present effluent pipe and discharge at the present discharging point.

When the sedimentation tanks are cleaned, which is done every three weeks, the sediment is flushed through 100 feet of pipe into a covered sludge bed. Here it is mixed with lime and allowed to stand for three months. Lime is added three or four times during this period, at the end of which time it is of a stiff plastic consistence. It is then removed and allowed to stand outside the building until carted away to be used as fertilizer. No estimate of the amount of lime used could be obtained. The sludge chamber is twenty feet six inches long and nineteen feet six inches wide, and the sludge for each cleaning has an average depth of two feet.

The effluent at point of discharge into Butternut creek was clouded and emitted a slightly unpleasant odor. It showed putrescibility in less than sixteen hours. The outlet end of the discharge pipe at times will be covered with water, but there is no possible danger of back water entering the plant.

No chemical analyses of sewage have been made.

The illustrations show the exterior of the building, one over the sedimentation tanks and one over the sludge well; also there is shown two views of the contact beds, not yet filled, one view from the side and one from the end.

KINGSTON

The city of Kingston is situated about three miles distant from the west bank of the Hudson river on the Esopus and Rondout creeks. The city has a population of 26,000 but the sewage disposal plant is designed to care for the sewage of the second and ninth wards only.

An abundant water supply is taken from the Catskill mountains. Water is conveyed from Mink Hollow to Cooper's lake by one mile of twelve-inch pipe. From Cooper's lake, which is located sixteen miles from the city, which has an area of eighty acres, a storage capacity of 200,000,000 gallons, and which is 1,100 feet above tidewater, the water flows to reservoir No. which has an area of nineteen acres, a capacity of 45,000,000 gallons, which is 451 feet above tidewater and which is four miles from Cooper's lake. From reservoir No. 2 the water flows nine miles through twenty-inch pipe to reservoir No. 1. This reservoir also has an area of nineteen acres with a storage capacity of 65,000,000 gallons and is 351 feet above tidewater. Six and nine-tenths miles of eighteen-inch pipe carry the water from reservoir No. 1 to the city. Practically the total population is supplied with water and consumes 3,000,000 gallons daily or 11 gallons per head per day. The population of the second and ninth wards is estimated at 6,000 and the water consumption in those wards is about 692,400 gallons daily. The water system is owned by the city and is valued at $750,000.

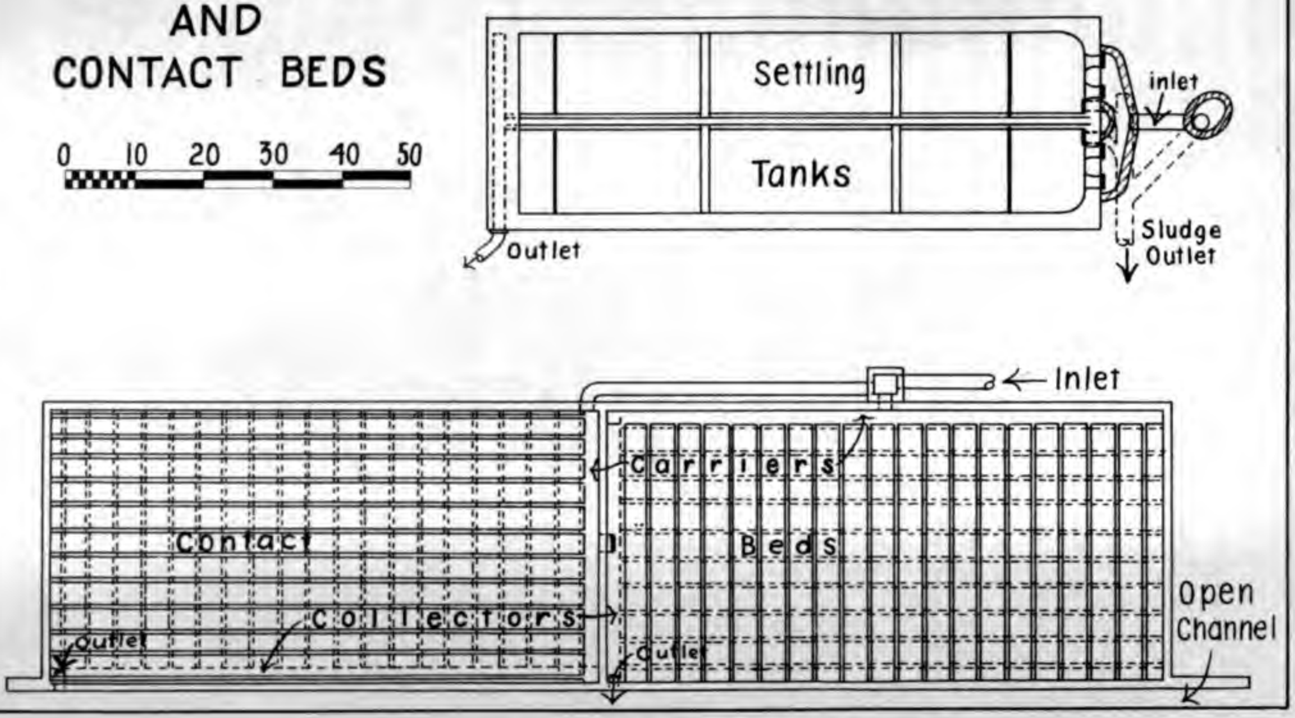
The sewage purification plant is designed for the second an ninth wards only. As designed for these two wards the syste comprises 49,500 feet of sewer pipe, 32,400 feet of storm wat sewers, thirteen flush tanks, with an average capacity of 3 gallons, the settling tank and two contact beds. About one-h of the population or 3,000 inhabitants have been connected to t system.

The sewage is domestic except for the waste coming fr the United States Lace Factory, and is daily diluted with ab 200,000 gallons of water that enter the system through the flu tanks. On Tuesdays and Fridays when the United States La Factory empties its wastes into the system the sewage partake brownish color, is hot and has an odor somewhat like tannic ac This condition lasts for about one hour. The remaining sixte industrial connections furnish only domestic sewage. Samp of the effluent taken from the lower contact bed at the point discharge were slightly turbid, had a slightly unpleasant od and showed putrescibility, less than seventeen hours being quired for a loss of the methylene color.

The sewage in its treatment enters a well at one end of t settling tank. Here it passes through one of two valves into o

KINGSTON

SETTLING TANK AND CONTACT BEDS



or the other of the two settling chambers. These chambers are about ten feet wide, fifty feet long and are divided into four compartments by concrete baffle boards. At the inlet end of the chamber these concrete baffle boards or walls extend to within eighteen to twenty-four inches of the bottom of the tank. The other two walls terminate about 3.5 and 4.5 feet from the bottom of the chamber. At the outlet end the sewage falls over a metal-capped masonry weir into an open channel which leads to a closed pipe. After flowing through about fifty feet of this closed pipe, the sewage enters the masonry well at the outside and center of the contact bed having the greater elevation. There are two contact beds, each with an area of one-sixteenth acre. Here, if the sewage is turned upon the first contact bed, it enters a channel about two feet wide, eighteen inches deep and extending along the entire length of the contact bed and covered with an iron cover. On the bottom of each contact bed has been placed ten rows of horseshoe tile and over these five feet of crushed stone of about 1.5 inches diameter. Just beneath the surface of the crushed stone nineteen rows of circular drain tile have been placed extending across the beds. These circular tile open directly into the open channel just mentioned and distribute the sewage over the surface of the contact beds. The sewage percolates through the crushed rock, is collected by the horseshoe tiles and leaves the contact bed on the opposite side from which it entered, discharging into a small brook flowing in a concrete channel against the contact beds. This brook, while furnishing natural drainage in its lower course, is at this point formed largely by the outflow from two storm sewers discharging within 200 to 300 feet of the disposal plant and the disposal plant effluent. The points of discharge are eight and four feet above the bottom of this channel so that the effluent discharges into the air.

The bed of the settling chamber slopes toward the inlet end of the chamber and the sludge is washed into an elliptical tile pipe entering the chamber at this end. By this pipe it is carried across the small brook into which the effluent discharges and is discharged upon a sludge bed having a length of about 200 feet and a width of twenty-five feet. Here, after each cleaning, it is treated with five barrels of lime and ten gallons of formalin and

allowed to remain indefinitely. The liquid portion may
into the brook or may be evaporated.

The sewage is allowed to flow through the contact beds f
period of about three months. The bed is then cleaned an
not put in service for three months.. The flow of sewage thro
the beds is continuous for the entire three months.

The illustrations are both general views of the whole plant,
from the west and one from the northeast.

LAKE PLACID[1]

Lake Placid, N. Y., is one of the largest and most p
lar summer resorts in the Adirondack mountains. It is a
2,000 feet above sea level, and its population, together with
of the hotels and cottages immediately about the village, varie
tween extreme limits of about 2,000 in winter and 7,00
summer. In general, however, the average summer populati
approximately double the winter population, and neither of
extreme limits continues for more than a short season.

To collect and treat the sewage of Lake Placid and the W
face Inn district, two systems of sewers and a sewage dis
plant have recently been constructed. The sewerage syste
the village of Lake Placid comprises about five miles of s
varying from six to fifteen inches, and the system in the W
face Inn sewer district comprises about four miles varyin
size from eight to twelve inches. The combined flow from t
two systems is treated in a disposal plant consisting of a do
chamber settling tank and six intermittent sand filters.
present disposal plant is designed so that its capacity can be
creased by the addition of another tank and more filters
siphons without interrupting the operation of the present pl
or changing the size of the present grit and dosing chambers.

The disposal plant is designed to be operated at half its m
mum capacity during the winter and the two compartments of
settling tank are accordingly equal in size. Each compartm
is 12 feet wide, 124 feet long, and 5 feet deep. The tank
built of concrete and covered with earth, two manholes

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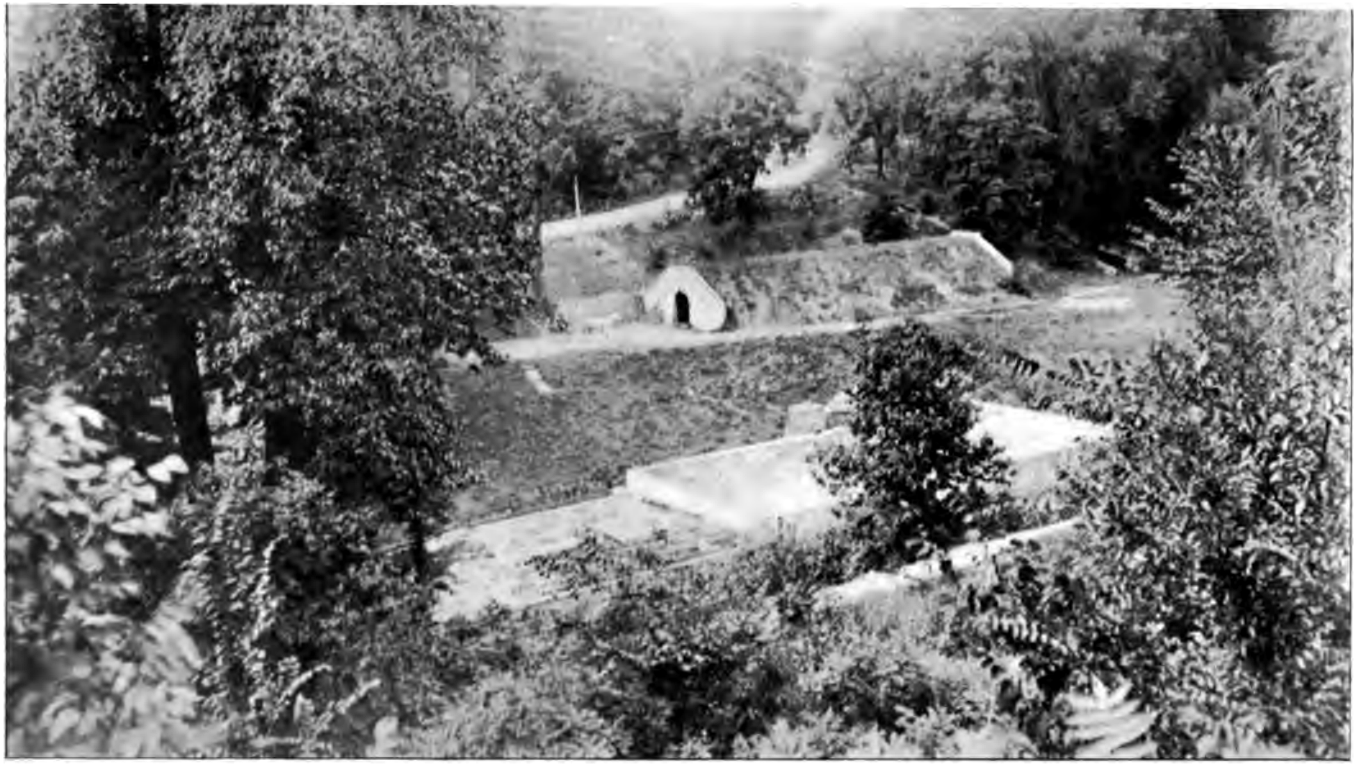
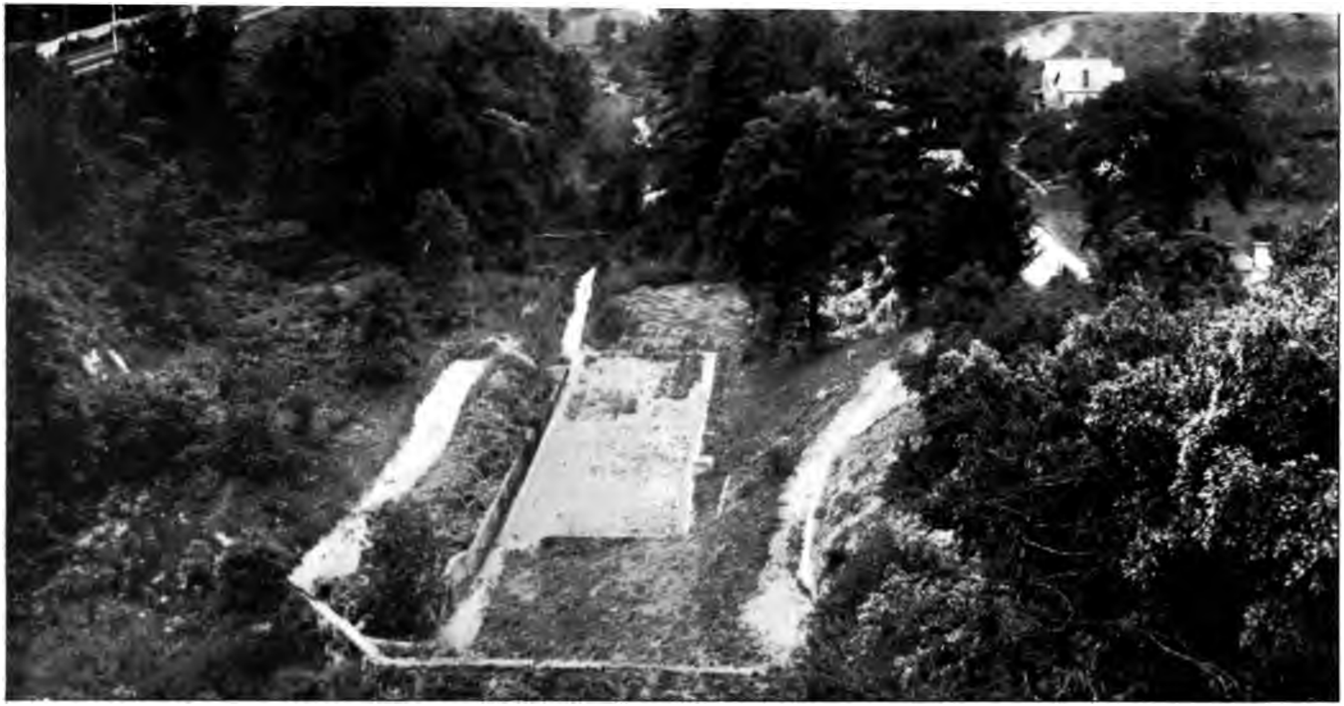
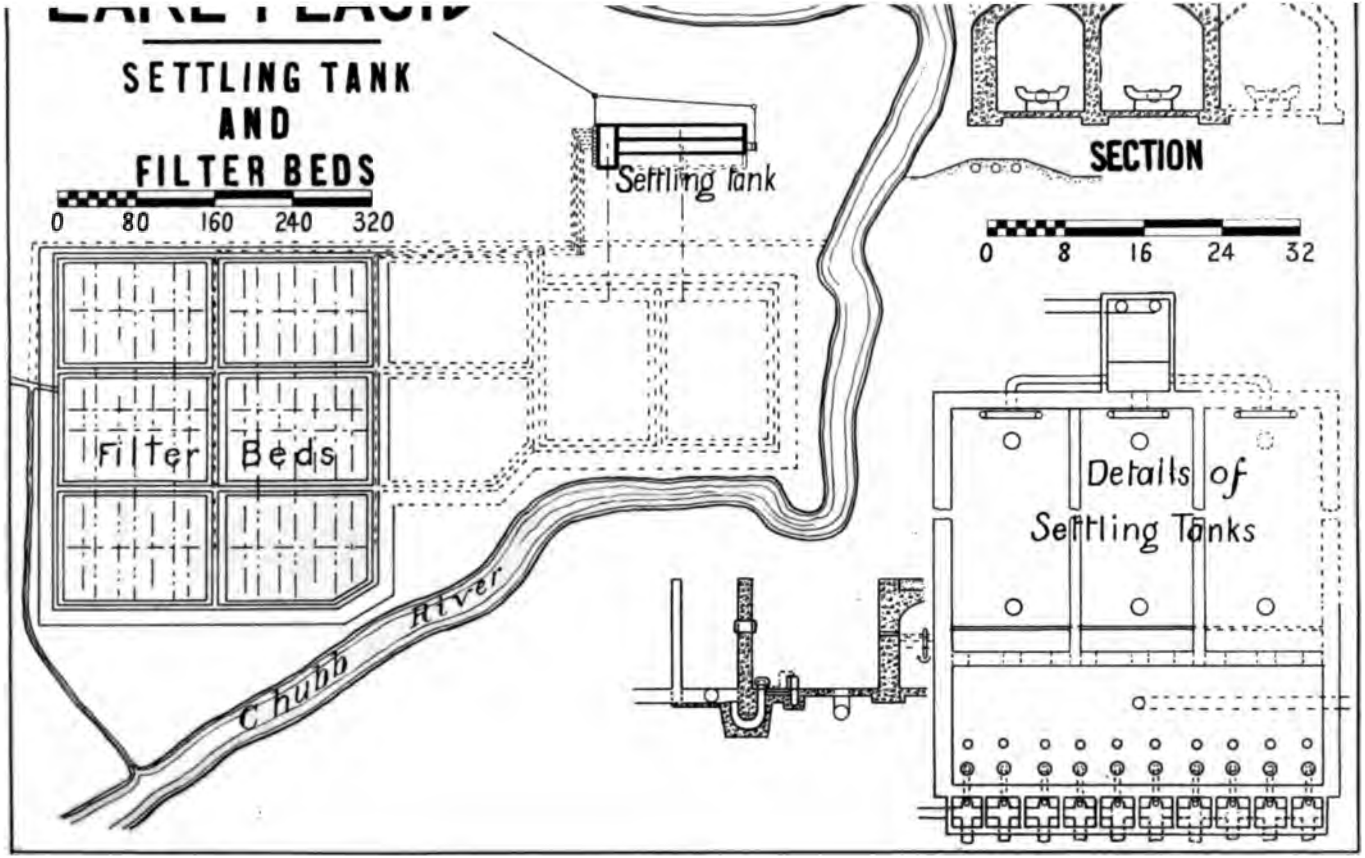
[1] This description taken from Engineering Record, Vol. 56, p. 714, in which
and section are shown.



Kingston. View of Settling Tank and Contact Beds from Railroad.



KINGSTON. CONTACT BEDS AND OUTLET BROOK. SLUDGE BED TO LEFT. SETTLING TANK TO RIGHT.


SETTLING TANK
AND
FILTER BEDS

each compartment being provided for ventilation. The flow from the main trunk sewer first enters a nine by six-foot grit chamber five feet deep, at one end of the tank. Between the grit chamber and each compartment of the tank is a controlling valve by which either compartment may be cut out. Just inside each chamber on the inlet pipe is a tee and on each end of each tee is a ninety-degree elbow and a short piece of pipe. The arms of the tees are of the right length to bring the discharge pipes to the outside quarter points in the width of each compartment. In front of each discharge pipe is a baffle board, placed so as to distribute the flow as evenly as possible throughout the cross-section of the tank.

Two feet from the wall at the outlet end of each compartment is a baffle, which extends down into the sewage half its depth, and in the end wall of each compartment are three weirs, the crests of which can be adjusted to any width up to a maximum of twenty-four inches. The sewage passing under the suspended bafflle and over these weirs flows into a twelve by forty feet dosing tank five feet deep, in which are six ten-inch Miller automatic siphons, supplied by the Pacific Flush Tank Company, Chicago. These are set to discharge in rotation and are arranged so that any number can be cut out, at the same time leaving those still in use operating in uniform rotation. Contiguous to the dosing tank are six small discharge chambers into each of which one of the automatic siphon discharges. From these chambers the effluent of the tank is piped to the six filter beds, any one of which may be put out of service by cutting out the siphon which serves this particular bed. The dose delivered on each bed at each discharge is 17,600 gallons, but this may be varied by setting the siphons to discharge at different depths. There is a bypass from the dosing tank by which the tank may be operated without filters. There is also a bypass through which raw sewage may be delivered directly to the filters without entering the tanks. There is no bypass, however, by which raw sewage may be discharged into the stream which receives the effluent of the plant. The floor of each tank slopes toward a depressed clean-out pipe and one chamber can be cleaned of sludge while the other is in operation. Each of the six intermittent filters has an area of four-tenths of an acre and a depth of sand of five feet. It was originally planned to use sand with an effective size of about twenty-five hundredths millimeters excavated from a side hill nearby. Eventually, however, it was found impossible to secure enough sand of this size without any excessively long haul, and accordingly a finer but carefully selected sand was used. The sewage discharged by each siphon flows through a separate pipe to the nearest corner of one of the filter beds. Here the flow is taken by two tanks laid in the embankments of the beds and is delivered equally at four points on the perimeter of each bed from which points it is further distributed by four lines of four-inch tile arranged as shown in the accompanying plan. Each drain is covered with about six inches of gravel or crushed stone and about two inches of coarse sand. The collecting drains lead to a central intercepting drain which discharges into Chubb river.

Chubb river has a drainage area above the disposal works of about thirty square miles. About three miles below Lake Placid it flows into the west branch of the Ausable river, the water of which, about eight miles further downstream, is used for drinking purposes by the village of Wilmington. At this point the river has a drainage area of about 150 square miles. Before the sewage disposal plant was installed traces of pollution due to the discharge from the Lake Placid sewers were found in the water at Wilmington, although at that time less than half as much sewage was being discharged into Chubb river at Lake Placid as is now being treated at the disposal plant.

For much of the time since the construction of the works the use of the filter beds has not been enjoyed chiefly on account of the expense of operation. The village authorities have considered that the purification affected by the settling tank was sufficient and that since no use was made of the waters of Chubb river for drinking purposes, it has not been incumbent on them to purify the sewage beyond a point where no offensive nuisance is created. Complaints, however, have been received on account of their failing to utilize the disposal plant to the full, and they have been advised by the State Department of Health that it would be necessary for them to use the filter beds in spite of the added expense.

The sewage works of Lake Placid were designed by Mr. Charles E. Collins, consulting engineer, Philadelphia, Pa.

LEBANON SPRINGS[1]

This disposal plant is to care for the sewage of Columbia Hall hotel, situated at Lebanon Springs, N. Y. The sewage formerly discharged into a small stream and caused a very decided nuisance, intensified by the fact that the refuse from the Acetylene Gas Plant was also discharged into the same stream. A cesspool was originally located on the line of the sewer to intercept the solid matter of the sewage discharged into it, but was incapable of acting as intended because the capacity and shape of the basin as well as the style of inlet and outlet were unfavorable to the detention of the solid matter, and secondly because the high velocity at times of storm carried out of the cesspool all the solid matter and allowed it to be stranded along the banks of the little stream, into which the overflow discharged.

In order to improve these conditions a new sewer was laid in another direction and a sedimentation tank constructed of larger size with submerged inlet and outlet and with a dosing chamber operated by a siphon which discharges onto a series of six beds. The tank is about sixteen feet long by eight feet wide and about six feet deep, the dosing chamber being about one-half this size. The plan shows the general arrangement of the irrigation filters and the distribution system on the surface of the bed.

LIBERTY

Liberty is situated in the north central part of Sullivan county near the Mongaup river. The village is located in the Catskill highlands and though it normally has a population of 2,500 this is augmented to a much larger number, perhaps to 4,500, during the summer months.

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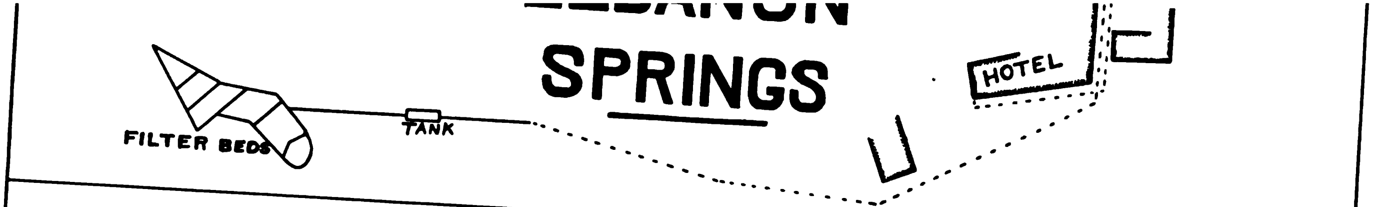
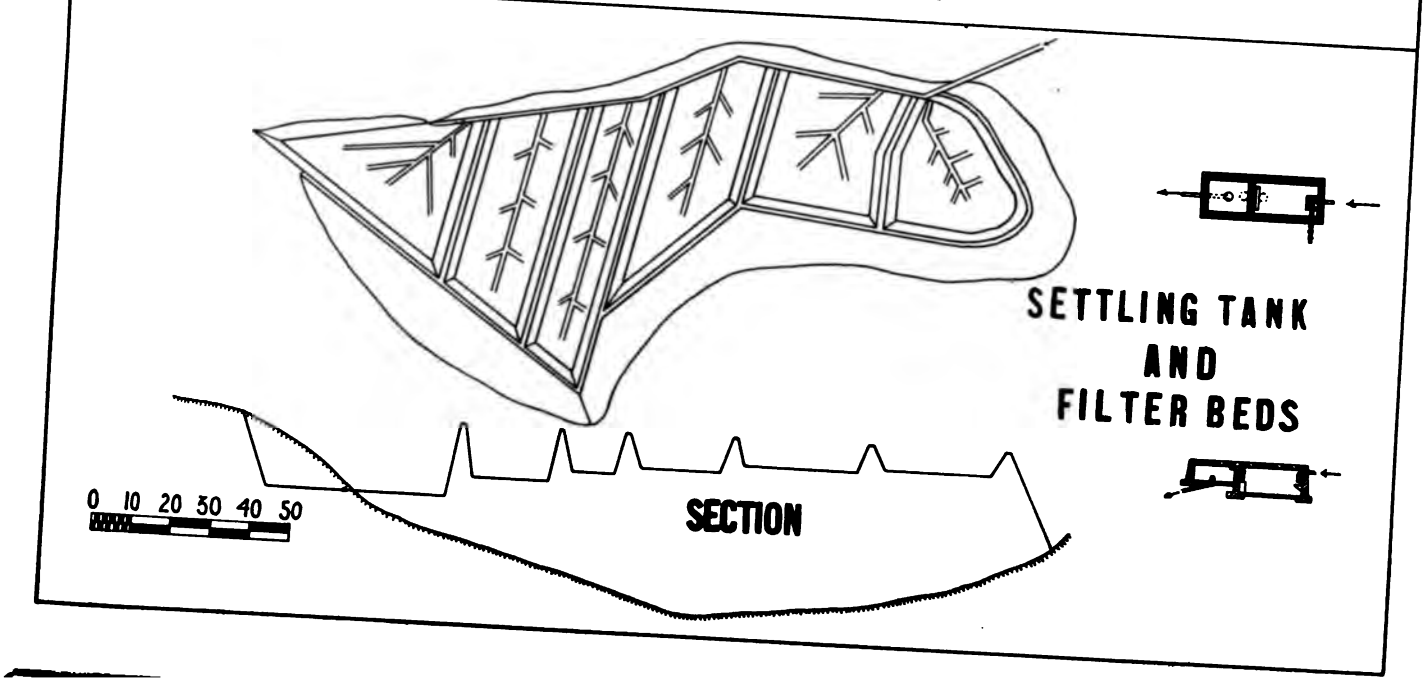
[1] Condensed from 23d Annual Rep't, State Dep't of Health, p. 175.

The water supply is taken from Revonah lake, distant 2.5 from the village. It is first pumped into a reservoir fifty square and eighteen feet deep and having a capacity of 300 gallons. The reservoir is 1.5 miles from the lake and one from the village and supplies water to the lowest part of the at a pressure of 132 pounds. The distributing system is miles long, the pipe ranging from ten inches to four inch diameter. Two thousand eight hundred connections have made to the system and through these connections 432,000 lons of water pass daily to the consumers. The system is by the village and has been in use since 1892. During months of the year a spring 100 feet from the reservoir furn an ample supply for all purposes.

The sewerage system which was put in operation in Au 1900, contains six miles of vitrified tile pipe, with ceme joints, seventy-five hundredths of a mile being eighteen in five-tenths of a mile being fifteen inches, one mile being tw inches and the remainder eight inches in diameter; thirty tanks, a settling tank, a set of primary, and a set of four sec ary contact beds. Neither storm nor underdrain systems been built. Five hundred and fifty connections have been to the system, including a laundry and a creamery. Of the th flush tanks, twenty are in use and discharge once in twenty- to thirty-six hours. The tanks are five feet in diameter and in depth from four feet to seven feet.

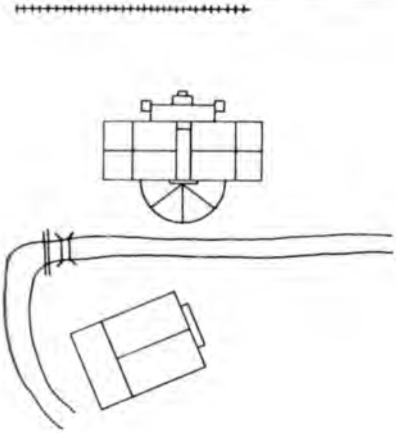
Entering the grit well (four feet long by six feet wide by feet deep) through an eighteen-inch tile pipe, the sewage enters one of two secondary sedimentation chambers, 11.75 long, 5.5 feet wide and nine feet deep. These chambers cleaned twice annually and at the time of inspection had a face scum eight inches deep and a depth of about three fee solid matter. At the time of cleaning these chambers, the matter is about 4.5 feet deep. From the secondary grit cham the sewage flows through forty feet of pipe into the new cham added to the tank five years ago. Holes in the partition wall tween the old and new parts of each chamber, of which there two, admit of the flow of sewage through the whole cham These chambers have a combined length of 116 feet and a w

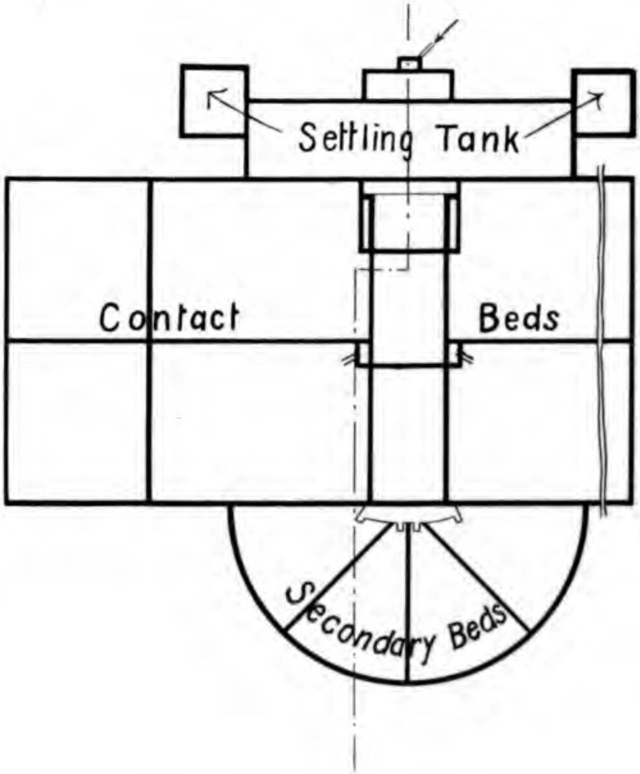


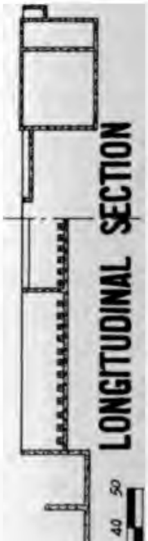

SETTLING TANK
AND
FILTER BEDS

LIBERTY

SETTLING TANK
AND
CONTACT BEDS







of 19.5 or 20.5 feet, and are cleaned every two years at which time a depth of about three feet of material is removed. From the chamber the sewage falls over a weir five inches below the top of the chamber into a shallow well twenty-four feet long, sixteen inches wide and ten inches deep. This well has at either end a metallic gate sliding in grooves, and the sewage may be turned at pleasure upon two of the four primary contact beds. The sewage is changed from one set of beds to another every two days, but before being turned upon the contact beds, however, the sewage enters through a square twelve-inch vitrified pipe, the housed chambers regulating the flow upon them. When first built there was installed in this house a system of buckets attached to gearings and so arranged that when one contact bed was filled a bucket also became filled. The weight of the filled bucket was sufficient to cause the bucket to drop and to move the gearing which closed the discharge outlet upon one bed and opened the same on another. The buckets did not operate well from the start and have not been used for some time. At present they and the gearing they operated are so corroded that they are useless. The flow of sewage through a set of contact beds is continuous, the beds in reality being used as filters. The contact beds are eighty-seven feet long and forty feet feet wide, the two beds forming one set of primary beds being eighty-seven feet long and eighty feet wide. On the surface of the contact beds were placed steel distributors 2.5 feet wide and nine inches deep. These distributors are placed along the longitudinal axis of the contact beds, and in the bottom of each was made four rows of one-inch holes one foot apart, the adjacent rows of holes being staggered. The contact beds are four feet deep and have a depth of 3.5 feet of cinders covering drain tile laid in rows two feet apart. The sewage collects in these tiles and enters a second compartment in the housed chambers regulating the flow upon the contact beds. From this compartment the sewage passes to the primary effluent well three feet wide, 19.5 feet long, and seven feet deep, from which it may leave through one of two channels. The channel near the bottom, a twelve-inch pipe, carries the primary contact effluent across Mongaup brook, to the three secondary contact or filtering beds built in 1902, while the upper channel, 1.5 feet deep and two feet wide,

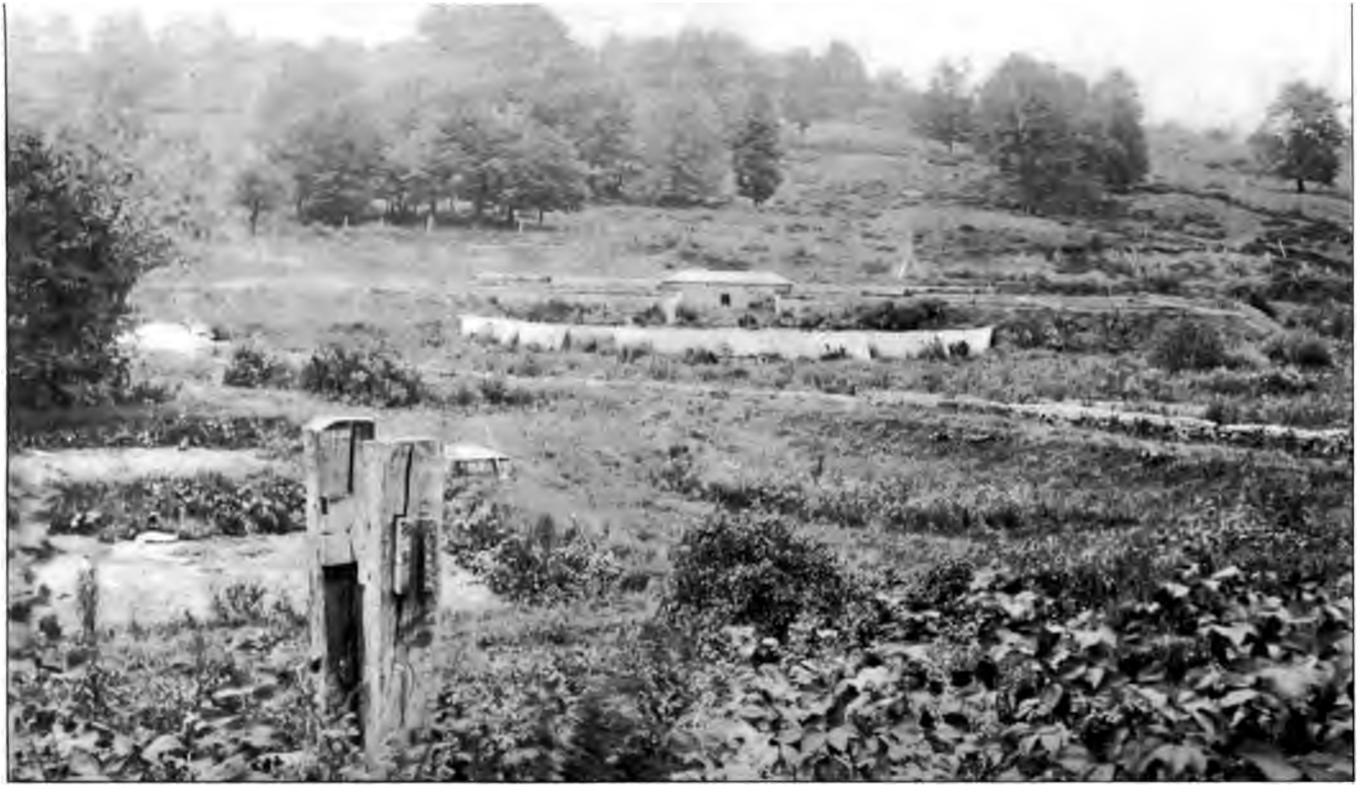
carries the primary effluent to the semi-circular secondary
tact bed adjacent to the primary beds. A gate valve in the lo
channel when closed causes the sewage to rise in the prim
effluent well and to discharge into the semi-circular second
contact bed. The secondary beds across Mongaup brook are fi
with cinders to a depth of 2.5 feet, and two have an area 100
long and 40 feet wide while the third is ninety feet long
forty-two feet wide; the semi-circular bed adjacent to the
mary beds is filled to a depth of about four feet, and has a ra
of forty-six feet. After crossing Mongaup brook on its wa
the secondary beds the primary effluent rises thirty inches
gravity to a rectangular well four feet wide, six feet long,
3.5 feet deep. In this well the twelve-inch pipe is reduced by
to three eight-inch pipes leading to the three contact or f
beds. Valves placed in this regulating well enable the atten
to turn the primary effluent upon any one of the secondary b
From the semi-circular bed the effluent discharges directly u
the soil about twenty-five feet from Mongaup brook through
proximately 20.6-inch tiles extending through the well. F
the beds across Mongaup brook the effluent empties into an
ditch 200 feet long and discharges into the brook.

Between the semi-circular contact bed and the brook was b
a brick sludge well into which sludge from the settling tank
to be washed. The well, however, is so small, about ten
square and seven feet deep, that it is not used.

The walls between the primary contact beds are in poor co
tion. As much as two to three inches of material have fl
from each side of the walls in places. The metallic distribu
have become so badly corroded that in places there remains b
film of metal, and in many places the bottom and sides have
altogether broken away.

The solid matter removed from the tank and grit chambe
carted across Mongaup brook and buried near the point where
secondary contact bed effluent empties into the brook.

Samples of the effluent taken from the discharge pipe of
secondary beds across Mongaup brook were slightly clouded
had little or no odor. The methylene blue color was retained
3.5 days or eighty-four hours.



Liberty. View Across Brook Showing Semi-Circular Secondary Bed in Foreground.

Liberty. Three Secondary Beds are Located Beyond Retaining Wall of Brook.

A rough measurement of the flow on August 27, 1907, gave the daily flow as 290,600 gallons, or about seventy-five gallons per day.

The cost of laying the sewers was $49,000; suits for damages increased the cost to $52,500; the cost of the disposal plant including engineering charges was $16,500.

The illustration shows a general view of the plant.

Cost of operation, annual:

Cost of cleaning grit chambers	$140 00
Cost of cleaning settling tank	700 00
Renewal of cinders annually	25 00
Attendant at plant	350 00
Supervision of plant, etc	25 00
Total	$1,240 00

References: New York State Board of Health, 1902, p. 279 and 280; Engineering Record, August 18, 1900; Municipal Engineering, July 1901.

LILLY DALE

Though but eight miles from the shore of Lake Erie the natural drainage of Lilly Dale, a summer camp sustained by an association of Spiritualists, like that of Chautauqua, is toward the Gulf of Mexico through Cassadaga and Conewango creeks into the Allegheny and Ohio rivers. The association property includes about forty acres of real estate entirely surrounded by Upper, Middle, and Lower Cassadaga lake, and the neck of water joining Upper and Lower lake. During the period from July 15th to September 1st, the population of the place is about 1,000, and the remainder of the year it is 150.

The water supply is obtained from wells driven at nearly every house, water being obtained at any point and in abundance by sinking a well from twelve to thirty-five or forty feet.

In 1893 the association built three cesspools and these with five private pools collect the sewage of the camp. The cesspools are wooden boxes made of two-inch hemlock lumber, and at the time of building could not have cost more than $10 each. To carry the sewage to the cesspools one-fifth mile of ten-inch pipe and three-fifths of a mile of six-inch pipe have been laid at a cost of $3,000. The sewage can scarcely be said to undergo purification, as the combined capacity of the three cesspools is but 700 gallons, and an average flow of thirty gallons per head per day would be sufficient to fill the pools from six and one-half times to forty-three times each twenty-four hours.

The 200 residences of the camp are connected to the pools and furnish a purely domestic sewage. From two of the pools the sewage is rather stronger than it is from the pool near the entrance to the camp, because this third pool receives considerable ground water.

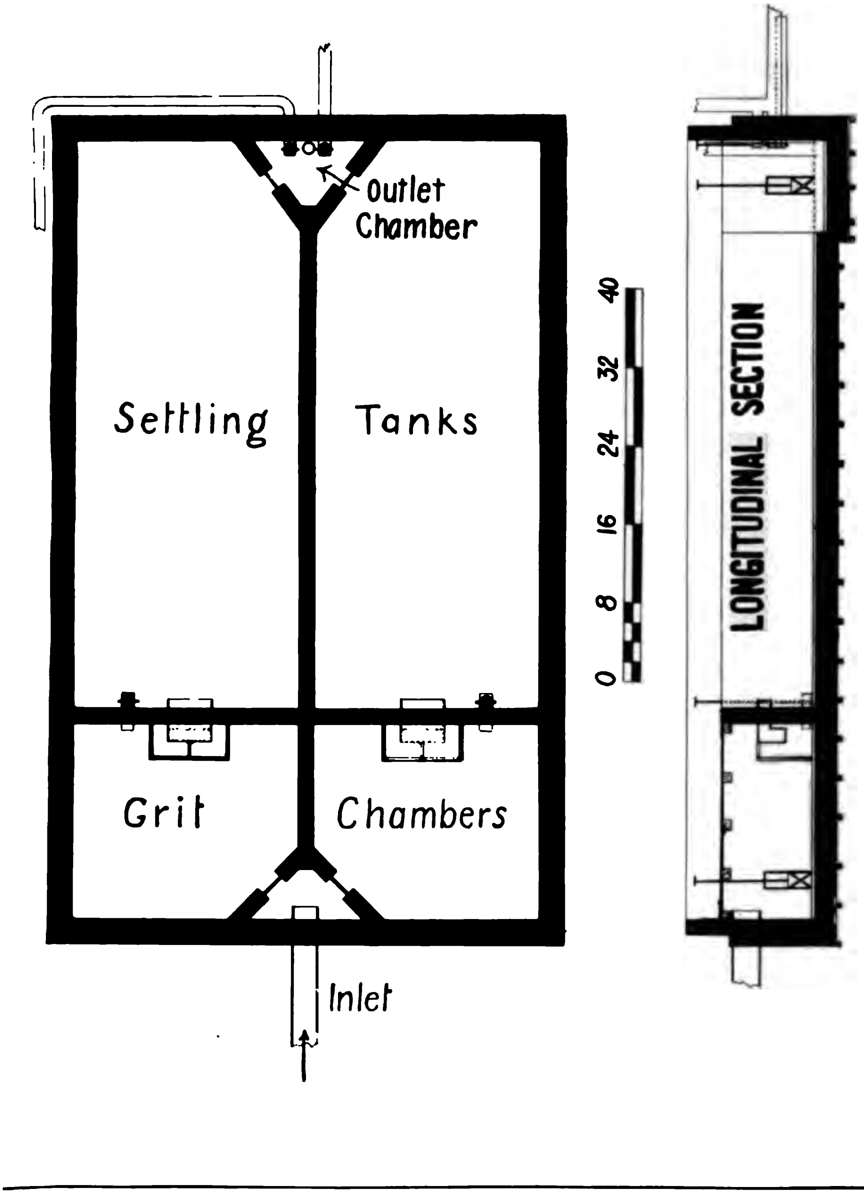
After passing through the collecting system the sewage enters one of the cesspools. The pool at the entrance to the grounds has a capacity of three barrels, while the other two have six barrels and eleven barrels respectively. The effluent from each cesspool is carried to Cassadaga lake through a six-inch iron pipe and discharges below the water surface. The pool at the entrance discharges about five feet from the shore line, but the larger pools discharge at points about 150 feet from the shore.

The pools are cleaned twice annually, in the spring before the camp opens and in the fall after the camp has closed. At each cleaning from twelve to thirteen barrels of solid matter are removed, the material being taken about 1,000 feet from the residences and spread on the dumping ground. No bad odor existed at this place at the time of inspection, though the matter taken from the pools had been deposited but about two weeks.

The small pool near the entrance is located about 250 feet from the shore of the lake, and in a spot so low that the surface of the pool is but six inches from the ground surface. In times of heavy rains the water collects in this low spot frequently covering the pool with a depth of twelve inches of water. The seepage of this water into the cesspool indicates as ready a seepage from the pool into the surrounding soil, and a possible contamination of the drinking water taken from wells less than 100 feet distant.

MANHATTAN HOTEL

SETTLING TANK



At the present time the use of water from one well in the vicinity of the pool has been discontinued because of its unpleasant taste, caused either by the soil itself or by impurities entering and contaminating the soil.

MANHATTAN BEACH

(In course of construction.)

Situated on the southern shore of Long Island, directly south of Brooklyn, are the two hotels popular as summer resorts, the Oriental Hotel and the Manhattan Hotel. The total population of the two hotels when filled to their maximum capacity is 2,500.

Water used at the hotels is taken from six wells about two and a half miles distant. One million five hundred thousand gallons can be pumped from these wells daily, but when pumped at this rate there is often a slight salty taste.

The sewerage system includes six miles of pipe in the collecting system ranging from thirty inches to four inches, the unarmored concrete purification plant designed to care for the sewage of 12,000 in addition to the regular hotel population, 1,000 feet of twelve-inch pipe necessary to carry the adulterated water from Sheepshead bay to the purification plant, and 1,100 feet of sixteen-inch pipe necessary to carry the effluent to the Atlantic ocean. How far the point of discharge will be from the shore has not yet been decided.

The sewage in passing from the thirty-inch sewer to the purification plant enters an equilateral triangular chamber with a side of ten feet six inches and nine and five-tenths feet deep, from which it passes through one of two thirty-inch sluice-gates into one of two grit chambers. From the grit chambers the sewage enters the settling tanks, passing through an L-shaped metallic casing supported by the wall separating the grit and settling chambers. This has its short rectangular opening pointing downward, the opening being fourteen inches wide and four feet six inches long. The lip of this L, over which discharge takes place, is four feet six inches above the bottom of the chamber. At the approach to this discharging L is to be placed a hinged

wire screen five feet high and resting on the bottom. This s
is of three-sixteenth-inch wire, and is to have a mesh of
tenths inch vertically and horizontally. The chambers are tw
three feet wide, fifty-eight feet long, and have a depth of nin
five-tenths feet. From these chambers the effluent ent
triangular pump well similar to the receiving well. Into t
fed ocean water from Sheepshead bay, and from it is pump
diluted sewage. The pumped sewage then enters the effluent
and discharges into the ocean.

A twelve-inch pipe and gate allows the solid matter
washed from the grit chamber into the settling tank, an
sluice gates allow the solid matter to be washed from the r
ing well into the grit chamber, and from the settling ch
into the effluent well.

The dilution of the sewage contemplated is three parts of
from Sheepshead bay to one of sewage.

Cost of purification plant:

Electric motors to operate pumps................	$1,2
Purification plant and labor to build same	2,0
Total cost	$3,2

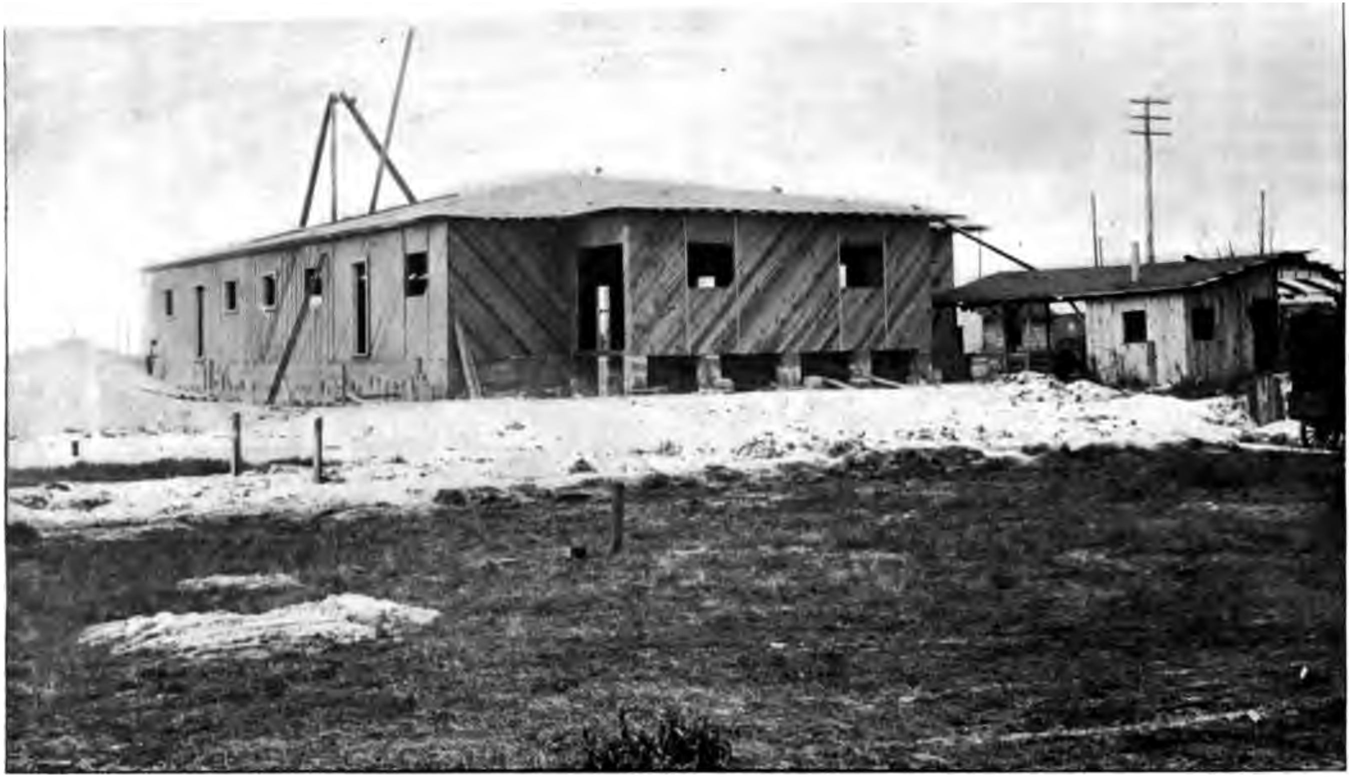
The illustration shows an exterior view of the plant.

MATTEAWAN

(Under construction.)

Nestled at the foot of Mount Beacon and on the Fishkill
about two miles from the eastern shore of the Hudson rive
the village of Matteawan, having a present population of
5,600.

The water supply is taken from two reservoirs, the M
Beacon reservoir, located on the north side of Mount Beacon,
the Melzingah reservoir located on the south side of Cal
mountain, fed by small streams and springs and partially



Manhattan Beach, L. I. Disposal Plant of the Manhattan and Oriental Hotels.

by the melting of ice and snow in the spring. The water from these reservoirs supplies both Matteawan and Fishkill Landing, the two villages having practically grown into one city. From October to July the water is taken entirely from the Melzingah reservoir, but from July to October this supply is supplemented by water taken from the Mount Beacon reservoir. From the Mount Beacon reservoir the water flows nearly half way down the mountain through an open channel into a small pocket or intake well. From this intake well and from the Melzingah reservoir the water is supplied through closed pipe to the two villages, furnishing water at a pressure of from seventy-five to eighty pounds. The water is supplied to eight-tenths of the population through approximately nine and five-tenths miles of pipe, the daily consumption being about 500,000 gallons. The system was installed in 1896.

The sewerage system was completed in October, 1906, and at present comprises some 51,400 feet of vitrified tile pipe, ranging in size from twenty-four inches to eight inches, over half of this being eight-inch pipe, and seventeen flush tanks with a capacity of 350 gallons each. These flush tanks are not provided with automatic siphons, as the fall of the sewers is sufficient to render unnecessary much flushing. To this system is to be added a settling tank and contact beds.

Of the population of 5,600 about 2,500 furnish to the system sewage, which at present is being discharged into Fishkill creek at a point about two miles above its junction with the Hudson river. From the five mills or factories that are undoubtedly to be connected to the system when the disposal plant is completed, but one will furnish other than domestic sewage. The sewage at present is very weak, being almost colorless and containing but a small quantity of visible solid in suspension. No unpleasant odor was noted at the discharging point of the sewer, and no samples for putrescibility were taken, as it would have been necessary to take sewage directly from the sewer pipe.

At the settling tank now being built the sewage is to collect in a grit chamber, eighteen feet wide and twenty-one feet long and about seven and five-tenths feet deep, the depth varying with the crest of the weir over which the sewage falls as it enters the settling tank. Passing over the wooden weir the sew into an open channel two and five-tenths feet wide, one tenths feet deep and extending across the end of the tank this channel it flows into one or all of the tanks over a weir two feet wide. There are three of these tanks fifty-s long and twenty-one feet wide, and at each end of the placed a wooden baffle to prevent disturbance of the s the sewage. In leaving the tank the sewage falls over a weir into the dosing tank, ninety-one and five-tenths feet twenty feet wide, and from this chamber it is fed to th beds by a siphon and through a twenty-four-inch pipe.

There are six of these beds 25 feet wide and 150 f and they are to be filled with crushed stone to a depth four feet. The sewage is to be collected in these beds b of a system of channels built in the concrete floor of and covered either with a five-tenths-inch crimped wo cover or with a perforated concrete top. The main chan the side of the bed is a twenty-four-inch channel and the feeding into it are eight inches.

The outlet pipe of each bed leads to Fishkill creek, about fifty feet from the beds.

The location is such that additions to both the cont and the settling tanks can be made at any time.

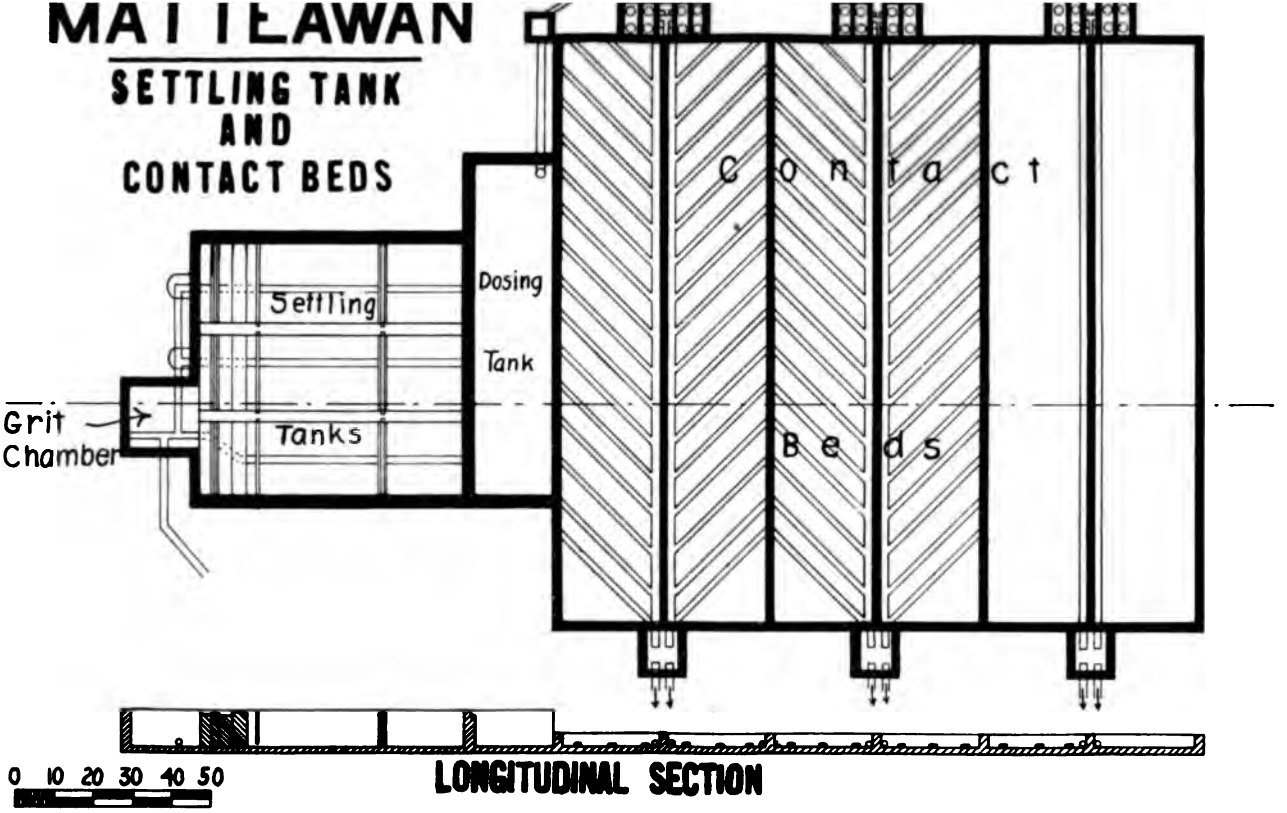
The effluent will probably be discharged into the Fishk within 200 to 300 feet from the tanks.

The storm system is about two and a half miles in len empties into Fishkill creek at various points.

Its cost was	$13
The cost of the house sewer system was	42
The estimated cost of the disposal plant, not including engineering services, is	63

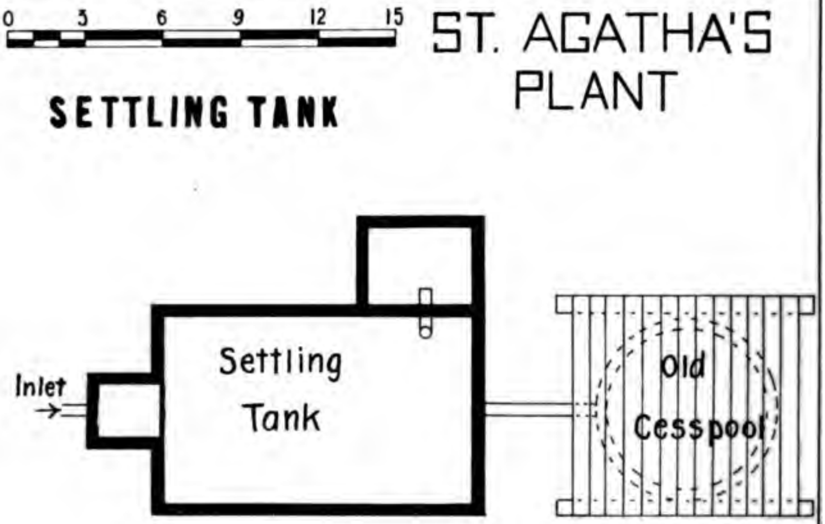
MATTEAWAN

SETTLING TANK
AND
CONTACT BEDS



ST. AGATHA'S PLANT

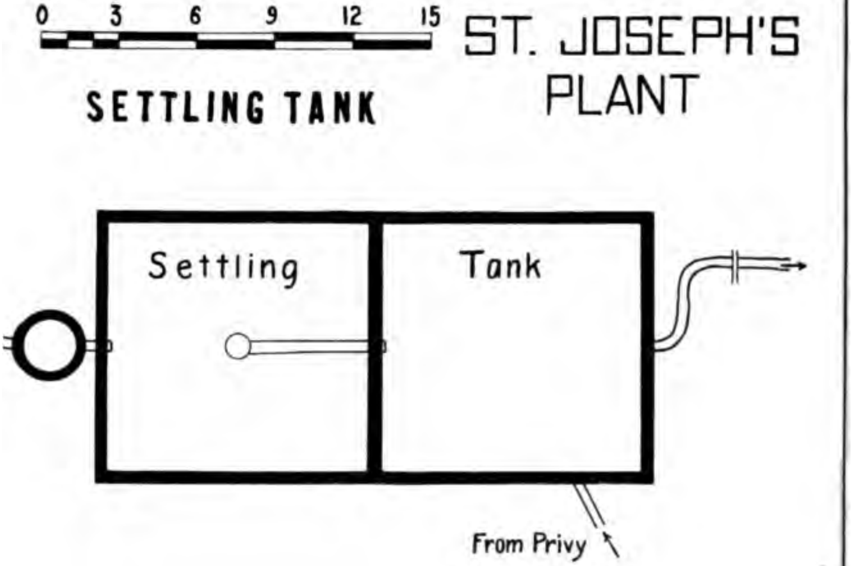
SETTLING TANK



NANUET

ST. JOSEPH'S PLANT

SETTLING TANK



ST. AGATHA'S HOME, NANUET

t. Agatha's Home at Nanuet, a home for Roman Catholic ians, lies upon the watershed of the Hackensack river, and t six miles west of the Hudson river. The attendance at the ne is about 1,600.

'he water supply is taken from a six-inch artesian well, 125 deep, from 10,000 to 12,000 gallons being used daily. A ond well eight inches in diameter is being sunk for an in- ised water supply, and a 50,000-gallon egg-shaped reservoir, feet high, is to be erected as soon as the well is sunk. The er is supplied to the seven buildings through 1,600 feet of . The present water system has been in use for twenty years.

'he sewerage system contains about 2,500 feet of pipe, the imum size being eight inches, and two small settling cham- . St. Joseph's plant discharges through an eight-inch pipe ing a length of seventy-five feet into a channel under a stone l running as the land drains. From this channel the effluent s into the soil. St. Agatha's plant discharges into marshy l about 500 feet from the plant. To the St. Agatha's plant o be added a contact area of crushed stone, which is to be ided into three beds having a width of 40 feet and a combined gth of 200 feet. The crushed stone is to be three feet deep.

'he sewage is domestic, receives no storm water except a ll quantity of roof water and only a very small quantity of nd water. In the St. Joseph's plant the sewage enters a nber ten feet wide, ten feet long and eight feet deep, in the om of which, and extending two and five-tenths to three feet rom the bottom, is a pipe through which the sewage flows to ond chamber ten feet square. From this second chamber it es the tank through an eight-inch pipe entering the chamber it four feet above its bottom. In the St. Agatha's plant the ge enters a shallow well two feet square and from this it s through openings in the wall to a chamber seven and five- hs feet wide, twelve and five-tenths feet long and five feet . At the outlet end of this chamber is a six-inch siphon tying into a second well of the size of the receiving well. **m this second well it passes to a third well six feet in diameter eight feet deep and distant forty-five feet from the chamber.**

Leaving the sedimentation well the sewage flows through thirty feet of six-inch pipe upon the marshy land at the discharging point of the plant. Samples of the effluent taken from the point of discharge of the St. Agatha's plant showed putrescibility in two hours, the methylene color almost disappearing in one hour. The odor given off at the point of discharge was offensive and the soil surrounding the discharging point was covered with offensive black sediment.

The chambers are cleaned by lifting the solid material from them. They are cleaned about four times a year and at each cleaning twenty yards of matter are removed. This is placed in a pit where it remains until used as fertilizer in the summer.

Thus far the cost of operation has been confined entirely to the removal of the sludge. This requires four men for two days at each cleaning or thirty-two days labor annually at a cost of about $75 to $100.

The sewerage system complete cost about $9,000.

NEW LOTTS

New Lotts or *East New York* is situated in the extreme eastern portion of the borough of Brooklyn and has a population of about 50,000.

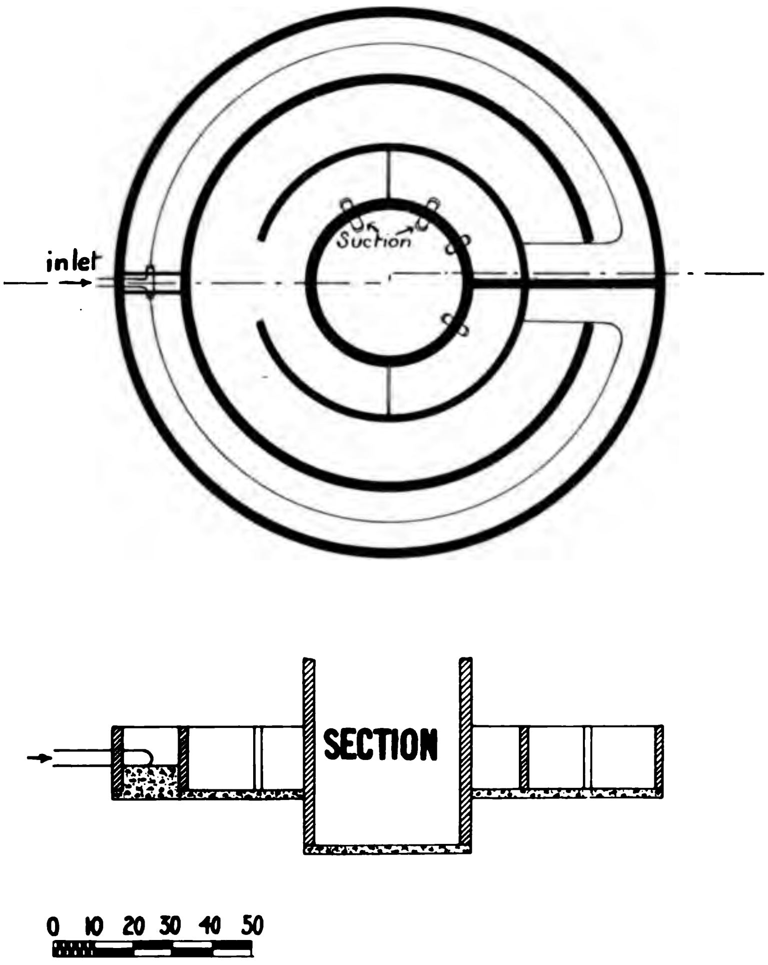
The water used is supplied by the German-American Improvement Company at the rate of 2,500,000 to 3,000,000 gallons daily.

The sewerage system includes a chemical precipitation plant designed by J. J. Powers, which is circular in plan, of a diameter of 140 feet, and contains two series of precipitation chambers. This plant is one of the two largest plants of this type in the State and daily receives from 11,000,000 to 12,000,000 gallons of sewage and surface water, the surface drainage of 3,200 acres entering the plant. The plant was put in operation in May, 1897, and has been in operation since that time.

The sewage enters one of the two semi-circular series of sedimentation chambers, each chamber having a width of sixteen feet and a depth of about seven feet, and traverses a distance of 300 feet before it reaches the collecting well at the center of the

NEW LOTTS

CHEMICAL PRECIPITATION



New Lotts or East New York. Plant Similar to that at Sheepshead Bay.

it. This well is forty feet in diameter and has a depth such
the bottom is sixteen feet below mean high tide. In attempt-
to handle the present flow of sewage it is necessary to use
series of sedimentation chambers simultaneously, and then
sewage is less than one hour in passing through the plant.
r entering the collecting well the sewage is lifted fourteen
by suction pumps and is discharged into a channel having an
ll weir twenty-six feet long. From this point of outfall to
ica bay into which the sewage empties the distance is 3,800
For this distance the effluent flows in an open channel.
re cleaning the sludge from the chambers chlorine is allowed
ss into it from thirty-six to forty-eight hours. The chlorine
erated from 108 pounds of acid, sixty-four pounds of com-
salt, and forty-eight pounds of manganese dioxide. An
us solution of the salt and manganese is first obtained and
id is then sprayed into it. The chlorine is discharged at
two pounds pressure. The lime used in purifying the
e is slacked and allowed to cool before being introduced
ne sewage and is used at the rate of one barrel to 200,000
s. The lime is introduced into the sewage at its point of
ce into the plant.

nples of the effluent taken at the point of outfall or outfall
were turbid, contained sediment in considerable quantity
howed a loss of the methylene color in less than thirty hours.
e repairs of the plant average about $1,200 per year. Eight
red tons of coal are used at a cost of about $3,300. The total
ing force includes an engineer in charge, three assistant engi-
, three stokers, and sixteen unskilled laborers.

he illustration is a general exterior view of the building,
h covers the sedimentation tanks.

NEW ROCHELLE

ew Rochelle is situated just without the limits of Greater
York in Westchester county and on the shores of Long Island
d. The population is 21,000.

he water used by the city is supplied by the New Rochelle

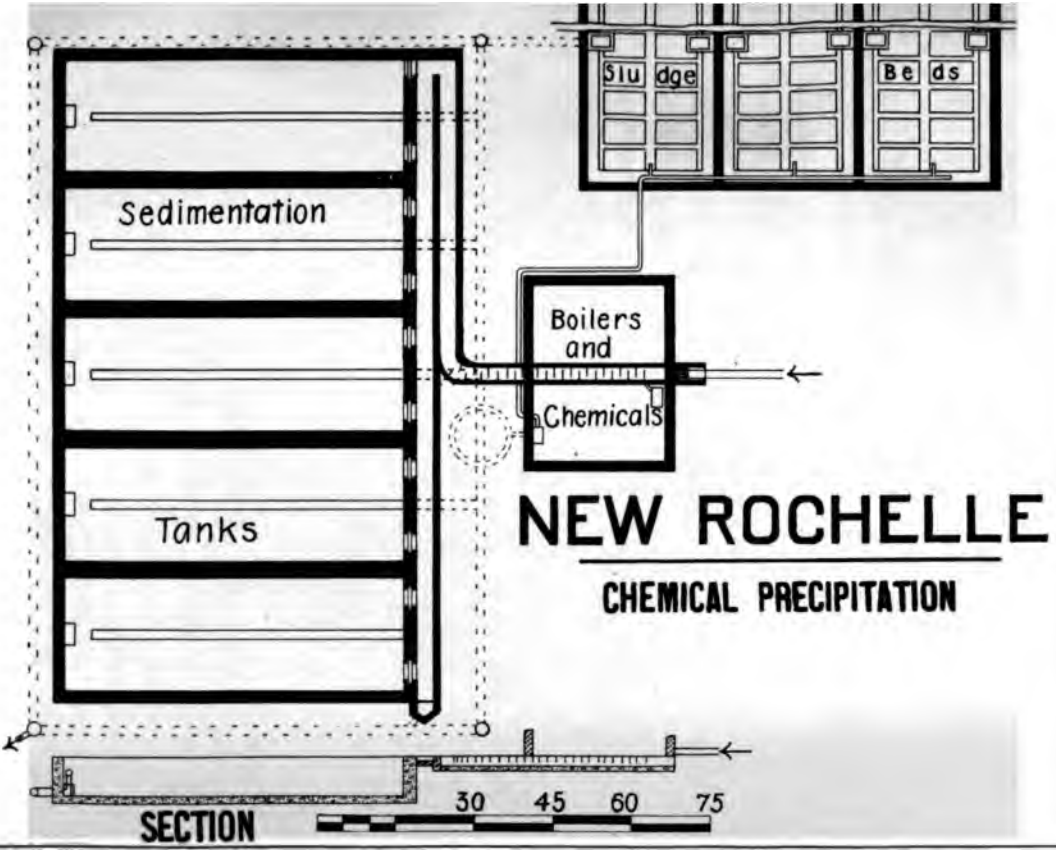
Water Company, and a description of the sources from whi receives its supply and the quantity of water available is g in the description of the Bronxville Disposal Plant. The w supply system in New Rochelle was laid in 1887 and con about seventy-one miles of pipe, to which 3,730 connections been made. The daily consumption averages 1,037,000 g or about fifty gallons per head per day.

The sewerage system of the city includes fifty-five mi sewers, which have been added to since 1889; 140 flush of a capacity of 200 gallons and equipped with the Van V automatic flush tank; and the plant for chemical treatmen part of the sewage. The pipe used in the system range twenty-four inches to six inches in diameter. Since 1895 thirty miles of vitrified tile have been laid. No underdrain been laid, but an average of six inches of broken stone w where underdrainage was necessary. A storm drain of no than two and five-tenths miles has been laid to care for s the storm water.

The sewage is received through 1,793 connections, and mestic except for a small amount of ground water and s water that may enter the pipes. At present but thirty flush tanks on the system are being used, and these discharg in every three, four, twelve or twenty-four hours, dependin their location.

The disposal plant was installed in the fall of 1895 a ceives the sewage of about one-third of the city adjoini town of Pelham. The flow from this part of the city is 500,000 gallons per day for a population of about 7,000. plant is situated at the foot of Morgan street, and discharg Long Island sound opposite Glen island, about 5,100 feet the plant.

As the sewage enters the plant it first passes through a of inclined bars two inches wide, three-sixteenths of an inch and four feet three inches long, spaced one-half inch cen center, and then through thirty feet of channel two feet from the sides of which project twenty-six concrete baffles s three feet apart. These plates are about one foot wide and teen inches deep, and are staggered along the two sides o influent or mixing chamber, causing the sewage as it p



NEW ROCHELLE

CHEMICAL PRECIPITATION

ugh to be thrown from one side of the chamber to the other.
r the entrance to this channel the lime and copperas are in-
luced and the subsequent agitation of the sewage causes a
plete mixing of the sewage and the chemicals. From this
nnel it enters a second channel three feet wide and six inches
p, from which it may flow into one of five sedimentation
ks, sixty-six feet long and twenty-two feet wide. When ob-
ations were made some years ago it was found that the sewage
uired about three hours and twenty minutes to pass through the
ks, but due to the increased flow of sewage the period is much
rter than that at the present time. From these five tanks it
ses into the effluent pipe and out into the sound, a distance of
00 feet. In front of the building is sunk a cistern twelve feet
liameter and into this from the sedimentation tanks is drained
sludge.

rom this well the sludge is pumped upon one of three sludge
s each having a length of seventy-one feet and a width of
nty-five and five-tenths feet, and the three having a combined
a of one-tenth of an acre. Around the inside of each bed and
feet below the top of the exterior walls is built a concrete
lf two feet wide, and within the area inclosed by this shelf
re are twenty-four concrete piers two feet high and having
ir tops on the same level with the top of the two-foot concrete
lf and separated from each other and from the concrete shelf
a depth of six inches of cinders on top of eighteen inches of
ken stone. These cinders fill the voids between the concrete
rs and serve as a filtering medium through which the liquid
aped with the sludge passes before it enters the three-inch
erdrain tiles leading to the two sludge wells at the center of
a bed. These six sludge wells are connected by a pipe dis-
ging into a manhole near the sedimentation chambers, and
n this manhole the filtrate flows along one side of the sedimen-
on chambers, through a second manhole and along a second
of the sedimentation chambers, discharging into the effluent
e of the plant through a total length of about 200 feet of
lve-inch pipe. The sludge when dry enough to handle is col-
ted in piles on the concrete piers in each bed and wheeled to a

point about 150 feet from the beds. The demand for the slud a fertilizer is sufficient to meet the supply, amounting to seventeen yards at each cleaning or 1,240 yards annually.

Three sedimentation tanks are cleaned at each cleaning an cleaned every five or six days. This necessitates the cle of sludge from one of the three beds in the same period of

Annual operating expense:

Fuel — Twelve tons of coal, at $6.50, and the lime barrels at nothing	$7
Engineer and two laborers, each $2 per day	2,66
Forty-five tons copperas, at $16	72
Four hundred pounds lime daily, at $16 per 2,000 pounds	1,16
Chloride of lime, one hogshead, or 400 pounds, at 45c per lb.	18
Total	$4,80

Estimated cost of disposal plant, $3,194.

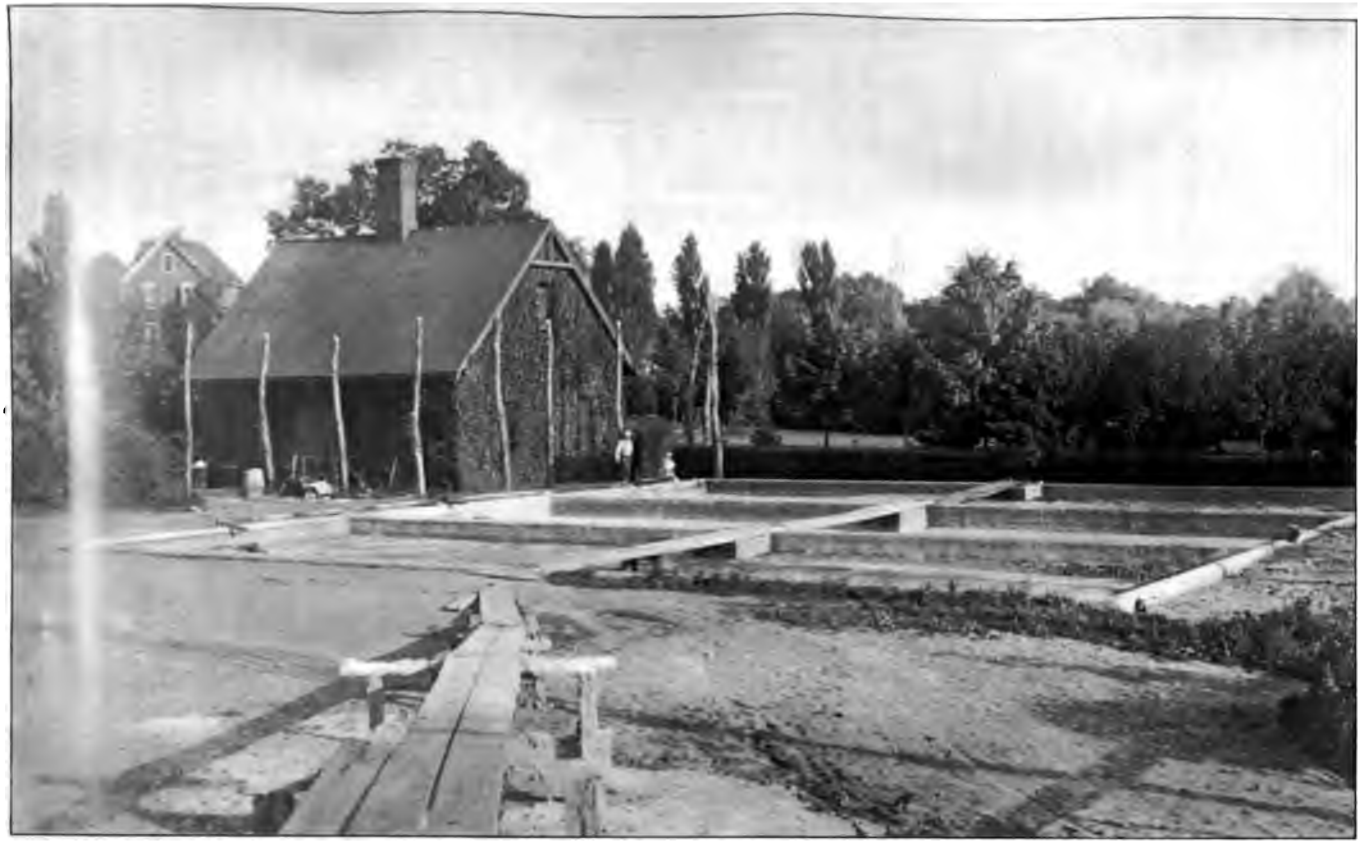
References: Engineering Record, March 9, 1895; Engi ing News, February 28, 1895.

The illustration shows the sludge beds.

ONONDAGA COUNTY HOUSE

Located at Onondaga Hill about seven miles from Syrac the Onondaga county house, an institution having an avera tendance of 350 people. It lies on the Oswego river wate though no streams of any significance traverse the country i immediate environment.

The water supply is taken from two reservoirs that are f springs. The larger of these has a surface area of twenty and a capacity of 65,000 gallons. The smaller of the two old reservoir that at one time was used in the Syracuse water ply system. It is located at a lower level than the large rese



New Rochelle. Sludge Beds.

and water is taken from it only when the supply in the large reservoir becomes exhausted or nearly so. At such times, but once in the last three years, the water is pumped from the smaller to the larger reservoir. The water feeds from the larger reservoir to the buildings by gravity, a pressure of about eighty pounds being maintained. From eight to ten barrels of water are used per hour or 6,800 gallons per day, this being less than an average of twenty gallons per head per day. The water supply is abundant, but has a slightly unpleasant taste and some of it that is being used as drinking water is being boiled.

The sewerage system was built nearly forty years ago and is intended to care for the sewage of the inmates and officers at the county house. As at present arranged it consists of two uncovered earthen cesspools and about 800 feet of pipe which carry the sewage to the first of the two earthen reservoirs. Two of the five buildings are connected to these pools, the dormitory which accommodates about 300, and the hospital which has an average attendance of forty-five. Only domestic sewage reaches the pools, the kitchen wastes of the main building being excluded.

The cesspools are each thirty-eight feet square and are separated from each other and surrounded by an earth bank four feet high, three feet wide at the top, and battered on both sides about four feet. The first tank or reservoir has a good septic scum over its surface and acts as a septic tank. The sewage in this pool varies in depth from three feet at the outlet end to one foot at the inlet end. From this first reservoir the sewage flows over a wooden weir into the second, which was intended to be used as a second sedimentation bed. Its surface is partly covered with the septic scum, but the outlet of this bed is less than ten feet from the point where the sewage from the first reservoir enters it and at present this reservoir plays no part in the purification of the sewage. The sewage flows directly around the corner of this second pool and the contents of the pool have ample opportunity to become stagnant. From the second bed the sewage feeds into an open channel eventually reaching the Oswego river through Onondaga creek, Onondaga lake and Seneca river.

Both reservoirs were cleaned in 1903 and at that time about eighty loads of material were removed and used as fertilizer.

The effluent holds some suspended matter but otherwise appears odorless. Samples of it, however, showed putrescibility in less than ten hours' time. No records of a chemical analysis of the sewage or effluent were found.

The only charge to operation is that of removing the solid matter deposited in the beds.

The illustration shows the two pools on which the scum is plainly visible.

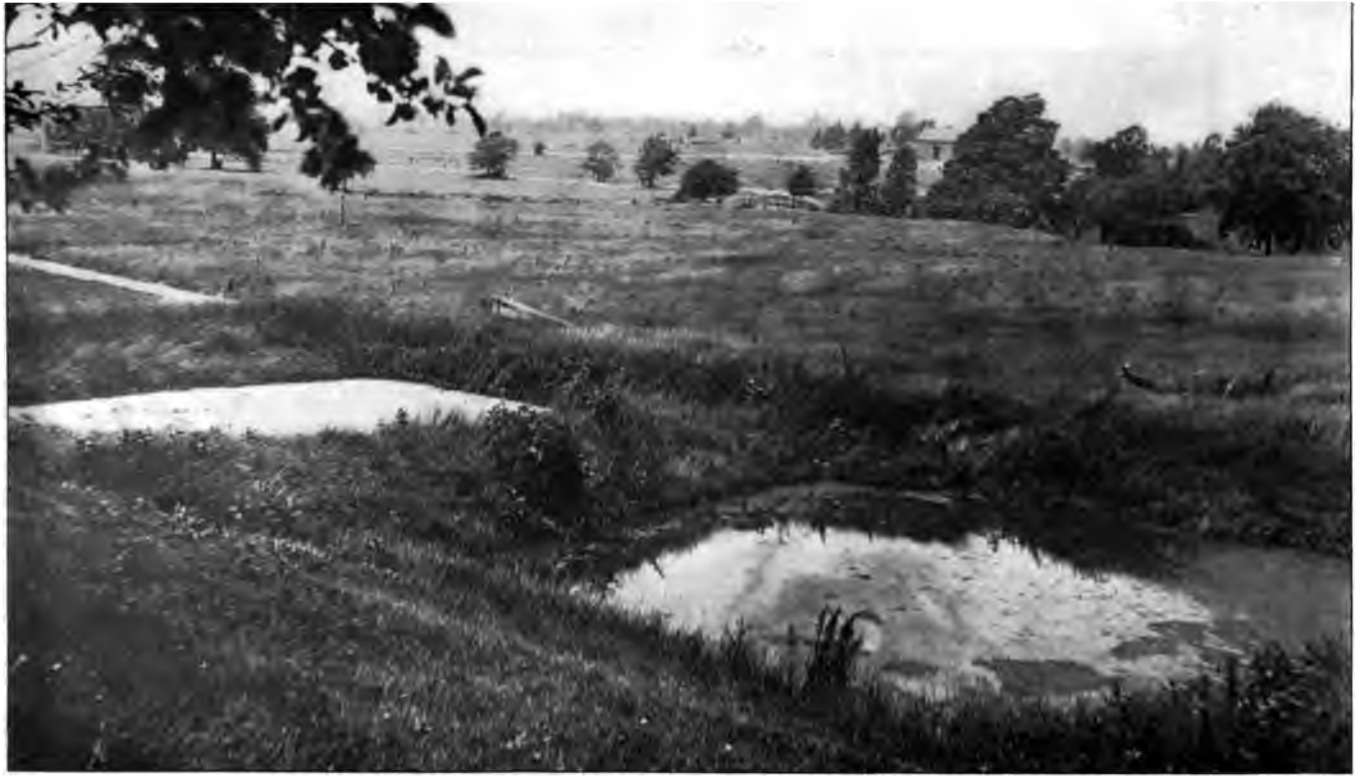
PENN YAN

Penn Yan is located at the northern and outlet end of Keuka lake and has a population at the present time of 4,700.

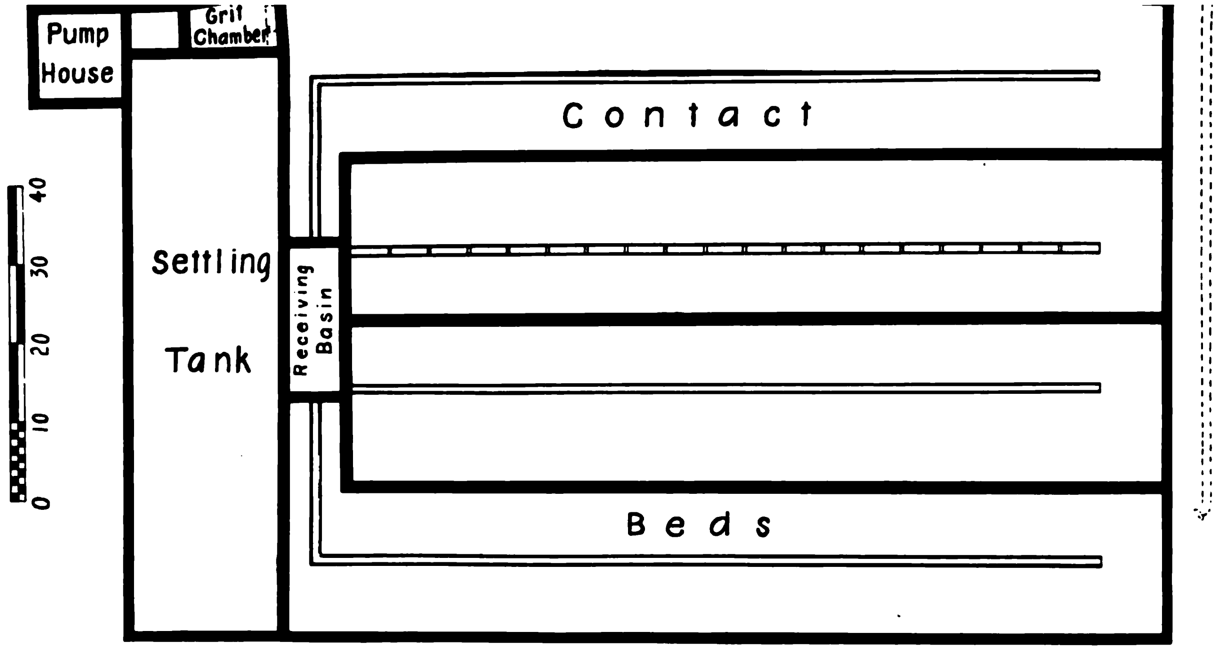
The water supply of the village is taken from Keuka lake and is both good and abundant, 500,000 gallons or 106 gallons per inhabitant being used daily. To furnish this water to the village fifteen miles of pipe have been laid and 1,200 service connections have been made.

The sewerage system and disposal plant were placed in operation in the spring of 1904 and since that time 460 connections to the thirteen miles of pipe of the sewerage system have been made. Included in this number of connections are six hotels, a shoe factory, the academy and the Vendor works. The sewage is, however, strictly a domestic one, being ordinarily kept free from storm water. A storm water system has been built and is intended to care for the storm water, but occasionally storm water finds its way into the sewer system. About one-half of the population, or 2,400 inhabitants, of the village has been connected to the system. Underdrains have been laid under most of the system but have no discharging point. A settling tank and contact beds purify the sewage before it is allowed to enter Keuka river.

In its treatment for purification the sewage first enters the grit chamber through a ten-inch cast iron pipe and a ten-inch head being discharged into the grit chamber at a point about two and one-half feet above the bottom of the same. After collecting in this chamber to a depth of five feet the sewage flows over the lip of an eighteen-inch concrete wall into a chamber which is eighty-eight feet long, twenty-two feet wide and in which the sewage col-



Onondaga. Pools of Sewage.



PENN YAN
SETTLING TANK AND CONTACT BEDS

cts to a depth of five and one-half feet to six and one-half feet, e depth varying with the slope of the bottom. At the opposite nd of this chamber the sewage enters either a twelve-inch cast on, standard ninety degree bend turned down with its bottom pening at a level three feet to four feet above the bottom of the hamber, or one of two standard twelve-inch T's with their opengs at the same level. From this bend and these T's it passes hrough fifty feet of pipe, supported by five eighteen-inch by wenty-four inch concrete piers, into the receiving basin.

The receiving basin is twenty-four feet long, eight feet wide nd in it has been placed an automatic feeding device so adjusted hat as soon as the sewage has risen to the desired depth in one ontact bed the gate in the pipe leading to this bed is closed and he gate guarding the opening to the next bed is opened.

In passing from the receiving chamber to the contact beds the ewage flows through wooden carriers along the sides of which, t intervals of three feet, have been bored one and one-half-inch oles. The sewage flows through these openings upon the surface f the crushed stone, filling the contact bed in the period of one ur. The sewage then stands for one hour in the contact bed ter which it is carried by twelve-inch vitrified tile drains, placed ound the bottom of the bed, to the siphons regulating the flow sewage from the contact beds, and which are so arranged that flow from the bed occupies about one hour. The contact beds ry from 125 to 134 feet in length, from 21.5 to twenty-four t in width, have a combined area of 0.27 of an acre, and are led to a depth of three feet with crushed stone. As first placed the beds the crushed stone was of two grades, the lower two et were of the size of stove coal, and the upper layer of one ot of the size of buckwheat coal. The surface, however, seemed clog, preventing the ready flow of sewage into the crushed rock, nd in the spring of 1907 the two grades were thoroughly mixed.

From the contact beds the sewage flows through 225 feet of fteen-inch pipe into Keuka river. The discharging end of this pipe, on the day of inspection, 5 p. m., June 25, 1907, was about wo feet above the surface of the river, rendering a rise of three feet necessary before water could back up to the manhole at the ontact beds.

Two samples of the effluent taken from the discharging p its outlet end though clear and having but a slight odor s indications of putrescibility in forty-eight hours. This c explained by the fact that at the time of inspection the aut apparatus was allowing the sewage to flow through bed n four constantly and little more nitrogenous matter than th moved by sedimentation was being removed.

No chemical analyses of the sewage have been made an impossible to say to what extent purification of the sewage complished.

It has not been found necessary to clean the sludge fr septic tank though a small amount was removed in the sp 1905.

The plant was designed by Messrs. Knight & Hopk Rome, N. Y.

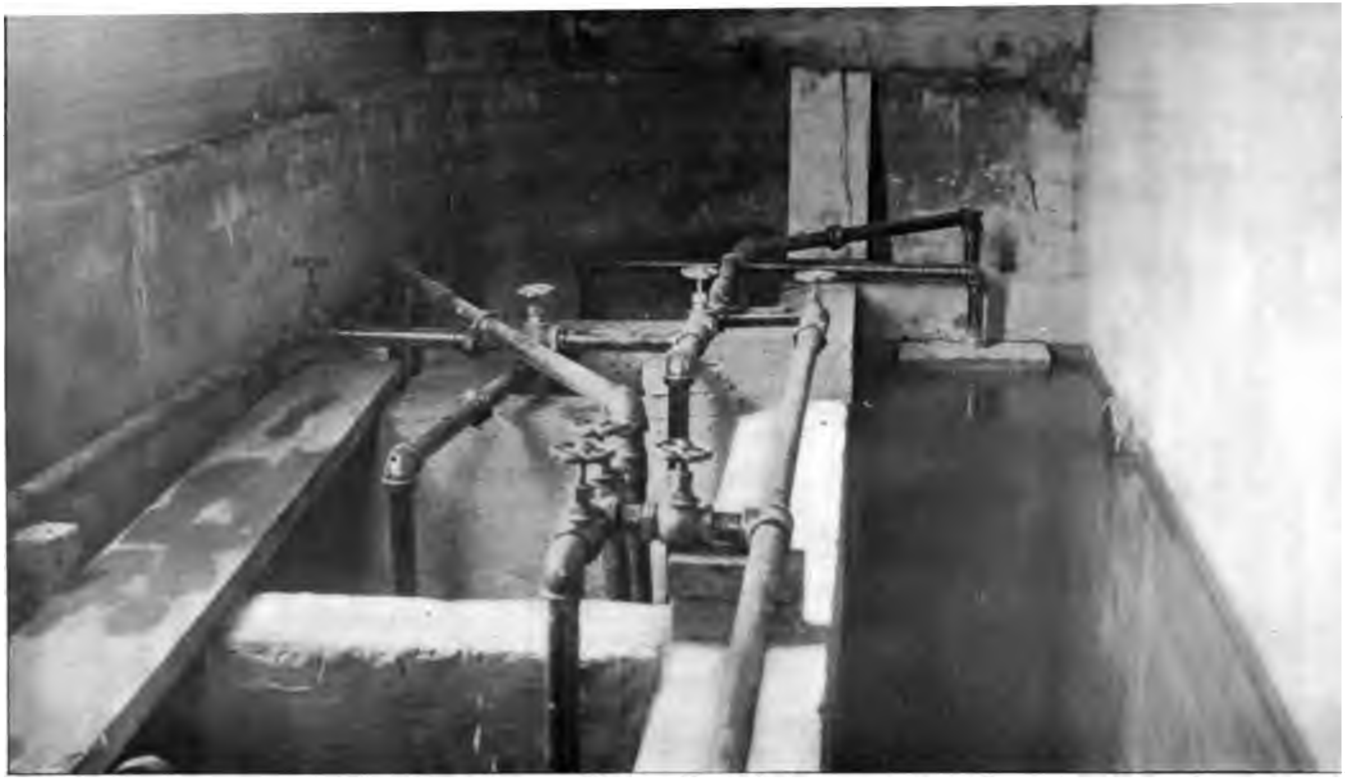
The illustrations show views of the exterior of the tan and of the contact beds. In the second view the sewage i seen escaping from the holes in the side of the wooden The third view shows the piping involved in the instal the automatic regulating apparatus.

PINE BUSH

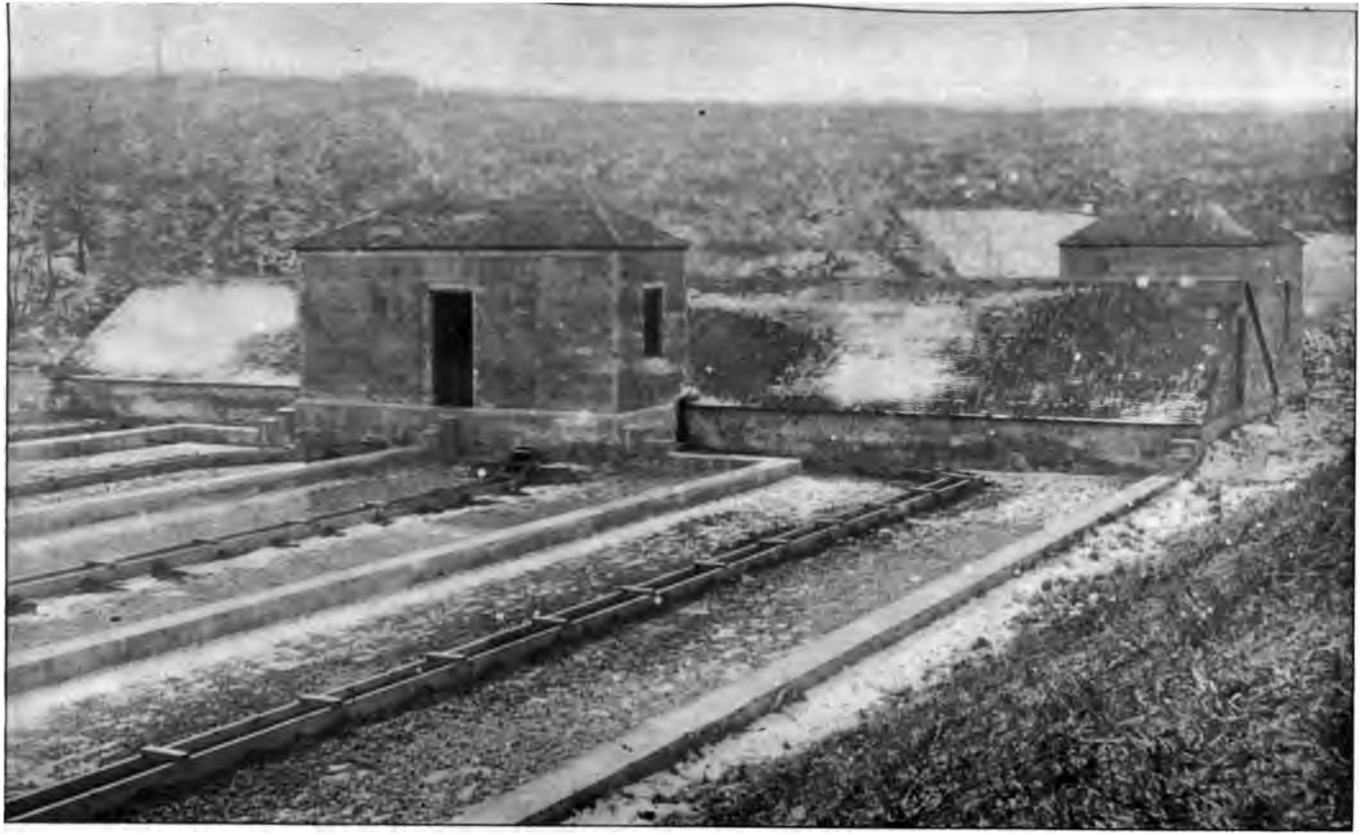
The Borden Condensed Milk Company has a condensin at Pine Bush, situated near the Erie railroad depot. Th pany engages about twenty-five employees.

A cesspool has been provided to receive the sewage and a has been built to receive the wash water of the utensils u handling the milk.

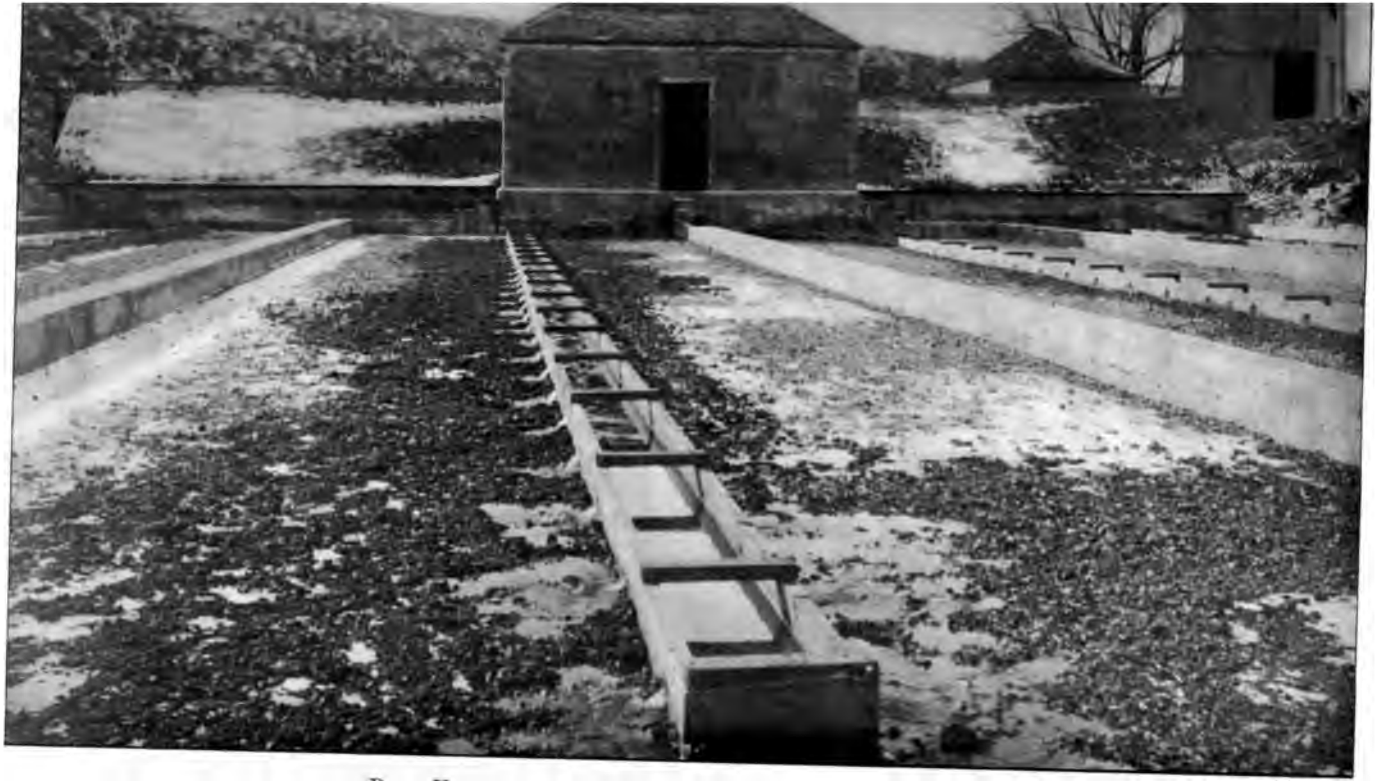
The cesspool which receives sewage is 4.5 feet square, sev deep and ten feet distant from the storehouse and has a b bottom. The brick walls of the pool are laid in mortar a eight inches thick. The sewage enters the cesspool throug inch vitrified tile pipe with cemented joints, and leaves t a four-inch vitrified tile pipe about fifty feet in length. T had been in use nearly one month on August 26, 1907. I tended to clean the pool twice annually.



Penn Yan. Automatic Regulator of Sewage Flow on Contact Beds.



Penn Yan. Settling Tank and Contact Beds.



Penn Yan. View Showing Filling of Contact Bed No. 3.

e pool which receives the wash water of the utensils used in ctory has an inside diameter of six feet, a depth of twelve and has walls of loose stone, not laid in mortar, and two hick. The wash water enters the pool through 200 feet of ch vitrified tile pipe discharging ten feet above the bottom pool. The 2,500 gallons of water which pass through the aily are carried from it by 900 feet of six-inch vitrified tile leaving the pool 9.5 feet above its bottom and discharging swamp. The effluent of this pool taken at the swamp was y and a sample of it showed putrescibility in less than fif- hours.

POUGHKEEPSIE, VASSAR COLLEGE

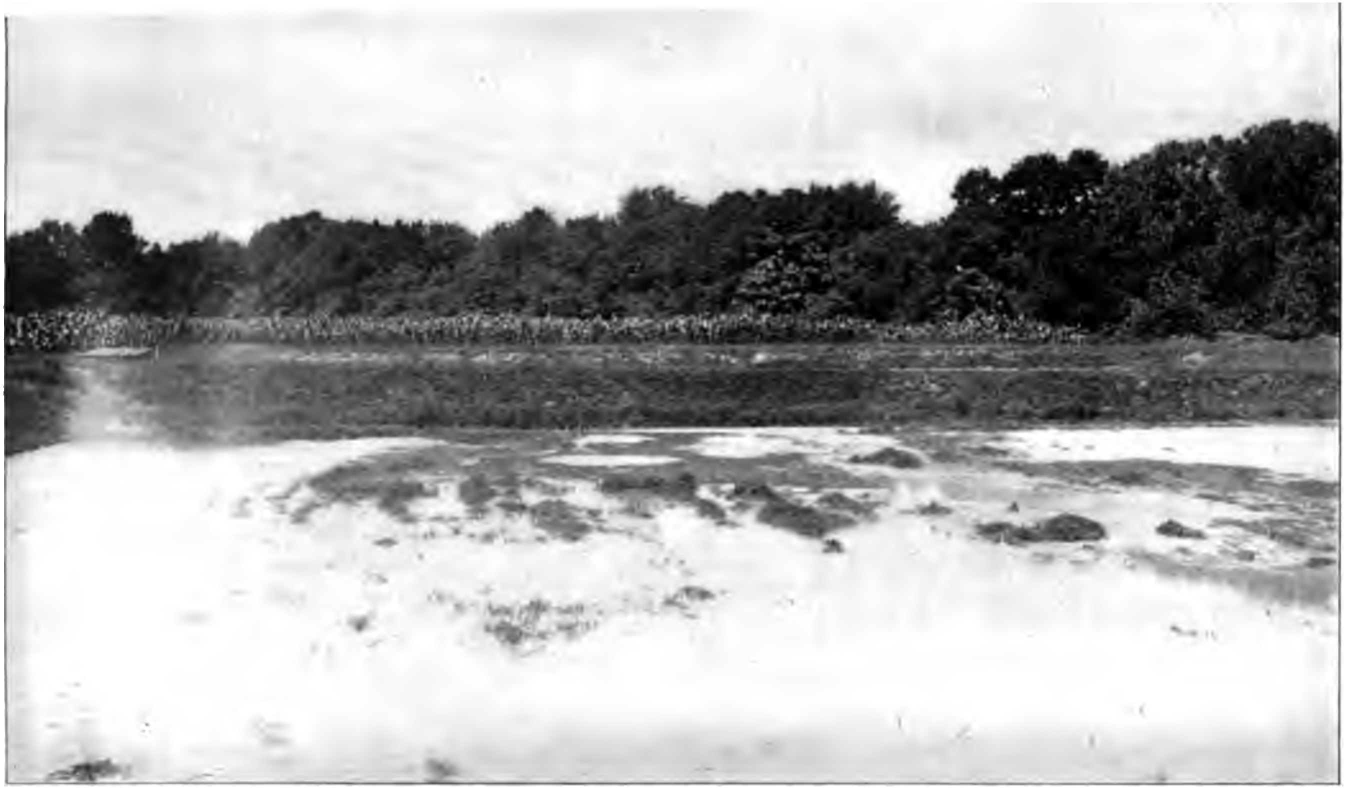
ssar College, Poughkeepsie, is situated on the Casper kill five miles from the east bank of the Hudson and has an at- nce of about 1,300, the total population connected with the e being about 1,350.

me sixteen years ago the water was taken from a spring but e present time it is taken from thirty-two fifteen-foot wells he college grounds. These wells are sheathed with six feet n feet square curbs, the tops of the curbs being eleven feet v the soil surface. The daily water consumption is 112,000 ns, an average of eighty-six gallons per head per day. The nearest the pump is 1,380 feet distant and the total ten-inch g necessary to carry the water from the wells to the pump is feet. The water is lifted by the pumps a distance of seventy into two iron tanks having a combined capacity of 23,550 ns and located in the attic of the main building. From reservoirs the water is fed by gravity to the twenty-nine ings ranging from 150 feet to 3,000 feet distant from the building. To supply sufficient water for use the pumps are working for twenty-one hours each day.

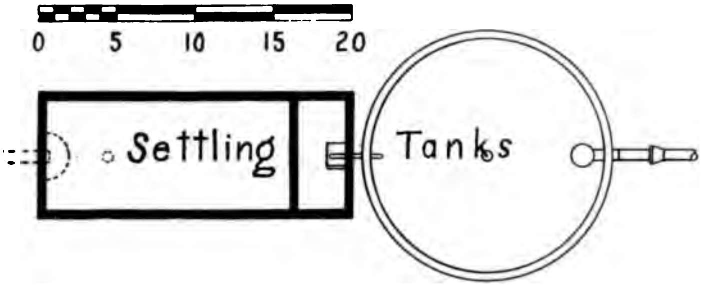
e sewerage system is made up of 600 feet of twenty-inch sewer, 3,300 feet of eight-inch mains plus the laterals neces- to carry sewage to them, two soil and sand filter beds having nbined area of an acre, about 500 feet of pipe through which ewage may be distributed upon eleven acres of farm land, a receiving tank twenty-four feet in diameter and twelve feet and a pair of eight-inch duplex pumps which pump the s upon the filter beds.

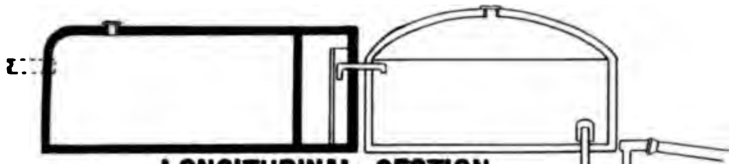
The sewage is not mingled with any other wastes and is c tic. In its treatment it is carried to the receiving well from it is pumped through an eight-inch cast iron pipe. Fro pumps it passes through 3,500 feet of six-inch main up two filter beds or upon the eleven acres of irrigating are described in the Engineering Record, June 27, 1896, "th prepared to receive the sewage consists of two beds with bined area of 1.03 acres, exclusive of embankments. Th terial is a rather coarse sand and has, with few exceptio effective size of from 0.3 to 0.4 millimeter. There were fine layers, but these were only of limited extent and we level, but had a considerable pitch, so that it was not thoug they would interfere materially with the operation of the The surface soil and loam were removed and a number of p of finer material were taken out entire. The ground wate was at least fifteen feet below the prepared surface of the and as there was a run near by affording a free outlet f ground water, it was not deemed necessary to underdra land. The bank between the beds which are 200 feet squ ten feet wide and has side slopes of 1.5 to one. "Fro outlets in the corners of the beds the ground falls away six in twenty feet, after which the surface of the beds is lev paving four feet square prevents washing of the soil at the of the inlet pipes." The sewage is allowed to run through until it does not readily filter from the surface. This varies from three or four weeks in the winter to two or months during the summer time. The surface of a bed is cl as soon as it is dry enough to permit of cleaning and the ac lated solid matter is removed to a convenient point about 20 from the beds. About 100 yards of solid matter are re annually and are used as a fertilizer.

The illustration shows one of the filter beds.



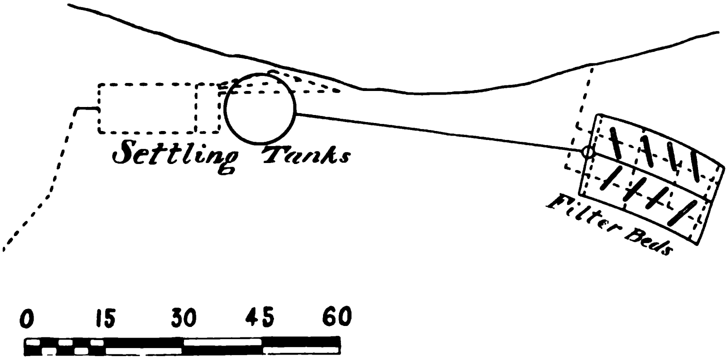
Vassar College. Filter Beds.





LONGITUDINAL SECTION

RAY BROOK



SETTLING TANK
AND
FILTER BEDS

RAYBROOK

October 20, 1903, the State Commissioner of Health ap-
d a plan for a settling tank as a preliminary part of a com-
sewage disposal system for the State Tuberculosis Hospital
ybrook, Essex county, N. Y., and the tank as planned was
the effluent discharging into lines of sewer drain tile laid
inches below the surface of the ground in the vicinity.

the fall of 1904 the attention of the State Department of
h was directed to the disposal plant, analyses made of the
e, and of the effluent, and the conclusion reached that the
nent in the settling tank was not sufficient and that the con-
ls were offensive and prejudicial to the health of the hospital
es. The superintendent of the hospital was particularly
us as to the matter and suggested the construction of filter
The remedy was finally found in the enlargement of the
ng tank, in the installation of intermittent and automatic
ns by which the discharge from the tank was made noncon-
ns, and by the construction of filter beds. This reconstruc-
was finished in the fall of 1906 and has proved satisfactory,
far as the disposal of the sewage without nuisance is con-
d.

ROUND LAKE[1]

und Lake is a summer resort on the Delaware & Hudson
ad near Saratoga Springs. The summer population averages
), but on some days there are 7,000 or more people on the
ds. The water works and a sewerage system were built in
the sewers and water mains having been laid in the same
hes. The only available water into which the sewage could
scharged was Round lake, close by which the buildings are
d, and in which it was essential that no nuisance should be
d. It was finally decided to put in a plant for chemical
nent and the plant of Mr. J. J. Powers, of Brooklyn, was
ed and installed about 1890. This place at Round lake
in minor details only from that in use at White Plains,

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[1] Condensed from an article by J. L. Fitzgerald, C. E.

Sheepshead Bay and New Lots. The sewage passes th [illegible] where heavy solids are precipitat thence into a larger chamber and through a screen where all l jects which have not settled are intercepted. The sewage p from this screen chamber into the adjoining chamber by mea an inverted trap [illegible]. This chamber into which the trap d [illegible] is a siphon chamber from which the sewage i discharged automatically into a long narrow chamber, from whi [illegible] another large chamber, and thence again into a final siphon chamber, from which the outlet pipe to the lake about 700 or 800 feet distant. Lime is admi the sewage as it enters the first compartment. Perchloride of iron was formerly admitted to the sewage before it passed throu first siphon, both lime and iron being discharged autom through feed boxes worked by lever floats. After the fir years of operation chlorine which had been generated in the b ing, and added to the sewage as an additional precipitant, ha omitted because of the corrosion of the pipes and fittings. aeration of the tanks has been found to be insufficient a methods of mixing the chemicals and sewage have been [illegible]. No information is available as to the character of effluent.

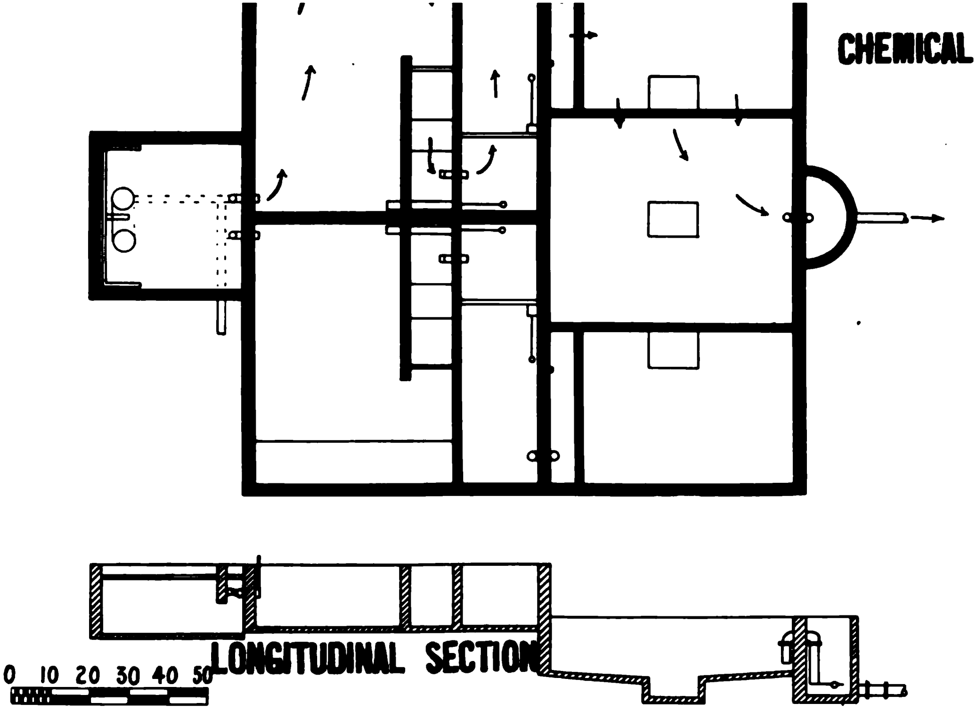
RYE MIRIAM OSBORNE MEMORIAL HOME

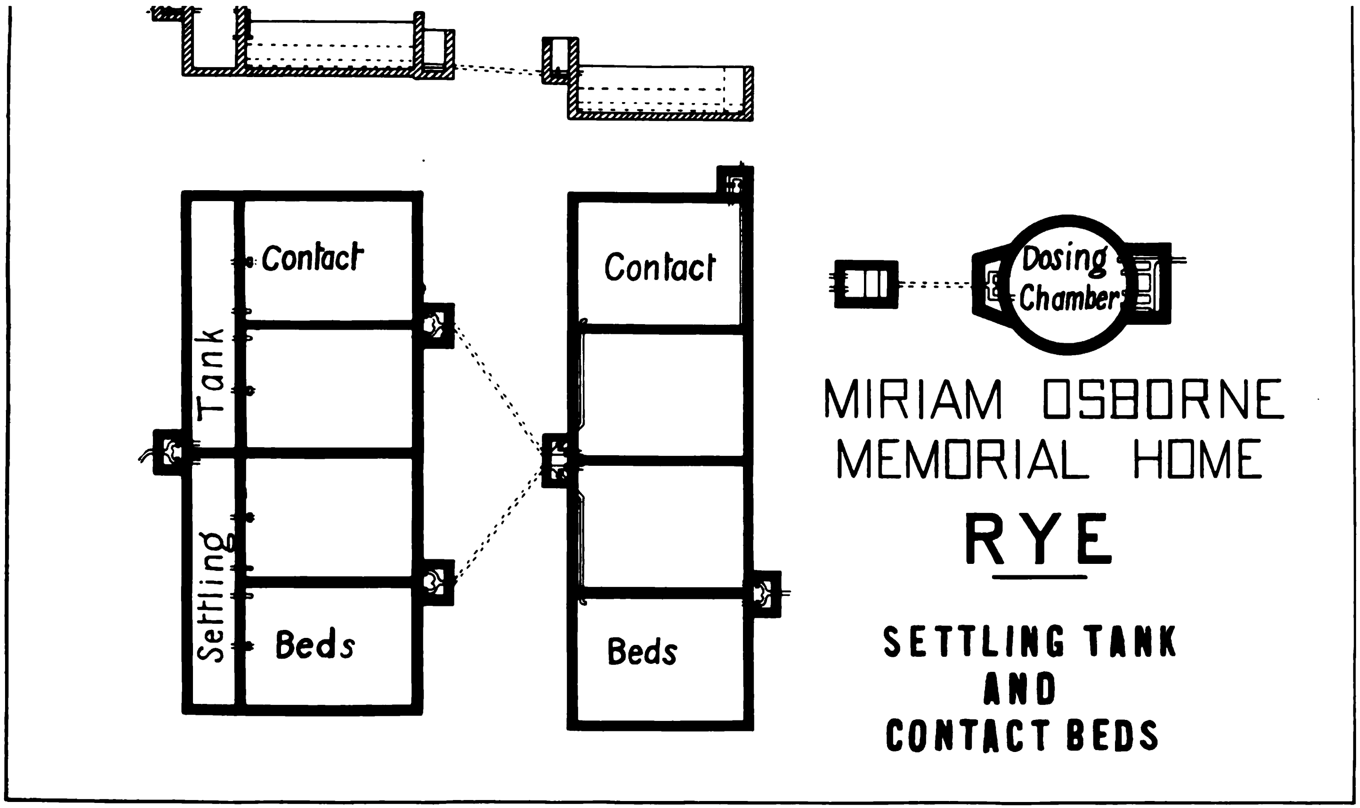
(Constructed but not yet in operation.)

The Miriam Osborne Memorial Home for old ladies is in the town of Rye, about one-half mile from the Harrison S on the N. Y., N. H. & H. railroad and is designed to acc 100 inmates and about seventy-five officers and help. It is on a prominence giving a commanding view of the cou miles in all directions.

The water supply of the institution is taken from a artesian well about fifty feet distant from the north and of the Home and pumped into rectangular reservoirs on about seventy-five feet from the building and then into tanks in the tower of the Home having a capacity of gallons.

CHEMICAL PRECIPITATION





MIRIAM OSBORNE
MEMORIAL HOME

RYE

**SETTLING TANK
AND
CONTACT BEDS**

ne sewerage system contains 600 feet of pipe, ranging from een inches to four inches, to carry the sewage to the puri- on plant and the purification plan embraces a screen cham- a dosing chamber and eight contact beds.

ne sewage enters a grit chamber through two six-inch pipes ng into a six-feet by four-feet grit chamber seven feet deep, h contains two screens having twenty-five hundredths-inch two feet long spaced two inches center to center and one center to center respectively and in the order described. six-inch pipe carries the sewage from the screen chamber to dosing chamber which has a diameter of sixteen feet and a th of twenty-two feet. From this chamber the sewage may r one of four short arm pipes all connected to sixty feet of nch pipe which forms the connecting link between the dos- chamber having a length of twenty-three feet and a width 6.33 feet and each having a layer of terra cotta tiles fourteen es by ten inches by four inches laid on the bottom of the nber, eighteen inches of one-inch gravel laid upon this and whole covered with three feet of two-inch crushed stone. teen feet from the primary contact beds the sewage flows out n a set of four secondary contact beds, counterparts of the ary beds, and from the secondary contact beds the sewage harges upon the meadow within four feet of the secondary act beds. At the entrance to, and at the point of discharge n the dosing chamber, the primary contact beds, and the second- contact beds are placed valves, to be operated by hand, which ulate the flow of sewage and from the dosing chamber and the act beds.

The plant is distant about 200 feet from the power house of Home and about 400 feet from the N. Y., N. H. & H. railroad is built on a side hill and the difference in elevation allows flow from one chamber to another to be accomplished by avity.

The valves leading from the dosing chamber are hinged valves erated by chains leading from the manholes of the dosing amber to the lower part of the valves. All other valves in the ant are gate valves.

The illustration shows a general view of the plant.

RYE PUBLIC SCHOOL

No. 3

One of the smallest of the institutional disposal plants in th State is that at Rye public school No. 3, Rye.

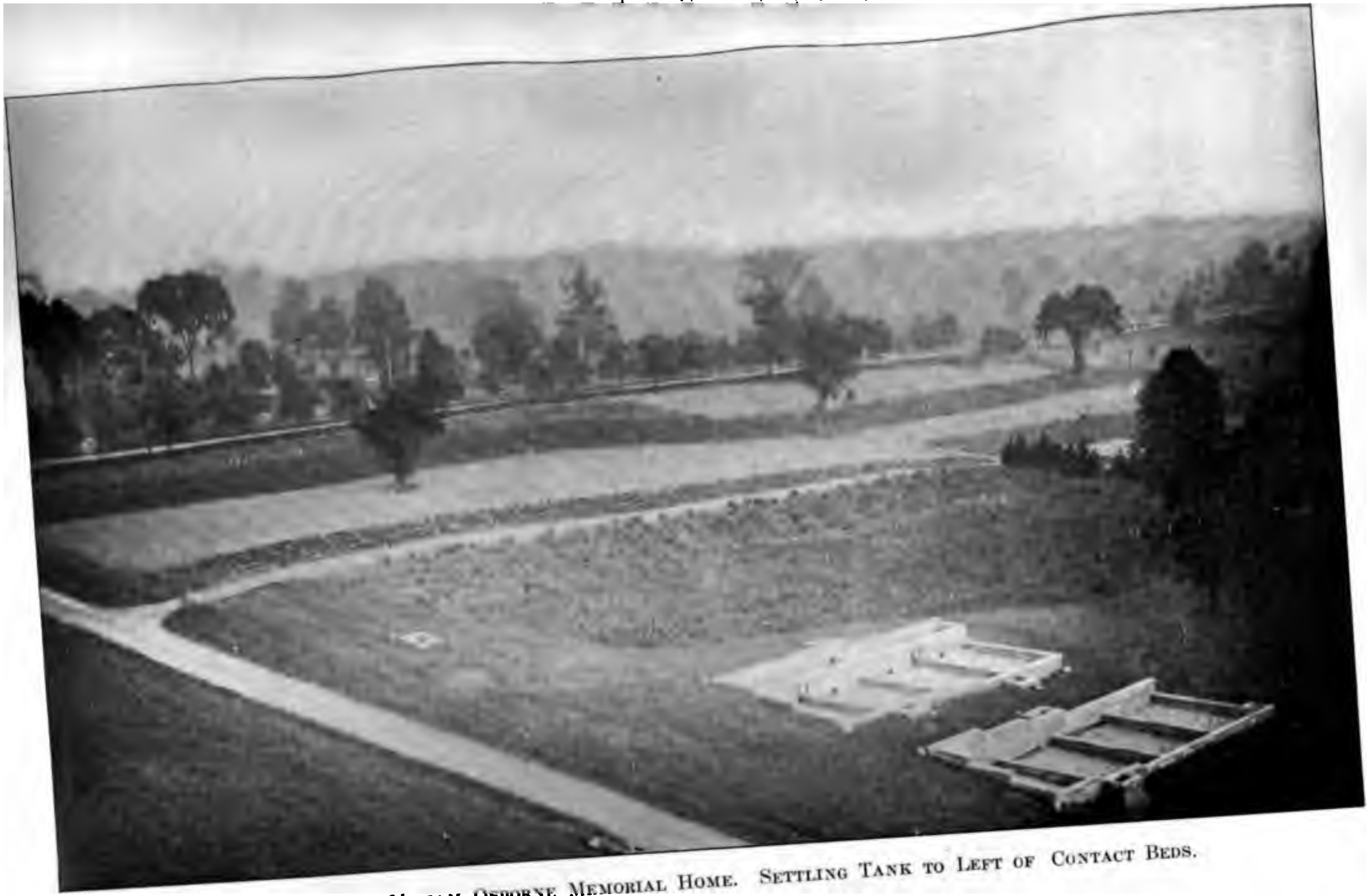
The water supply is taken from the mains of the Port Chest Water Company. The company collects its supply from tw small lakes having a capacity of 300,000,000 and 500,000,000 gallons respectively. Near the lakes is a standpipe into which th water is pumped and from which it flows by gravity to the consumers, one of which is the above-mentioned school.

The sewerage system comprises about 250 feet of piping necessary to carry the sewage to the purification plant from the school. the purification plant consisting of a settling tank and three contact chambers, and about eighty feet of pipe necessary to carry th effluent from the purification plant to the street sewer.

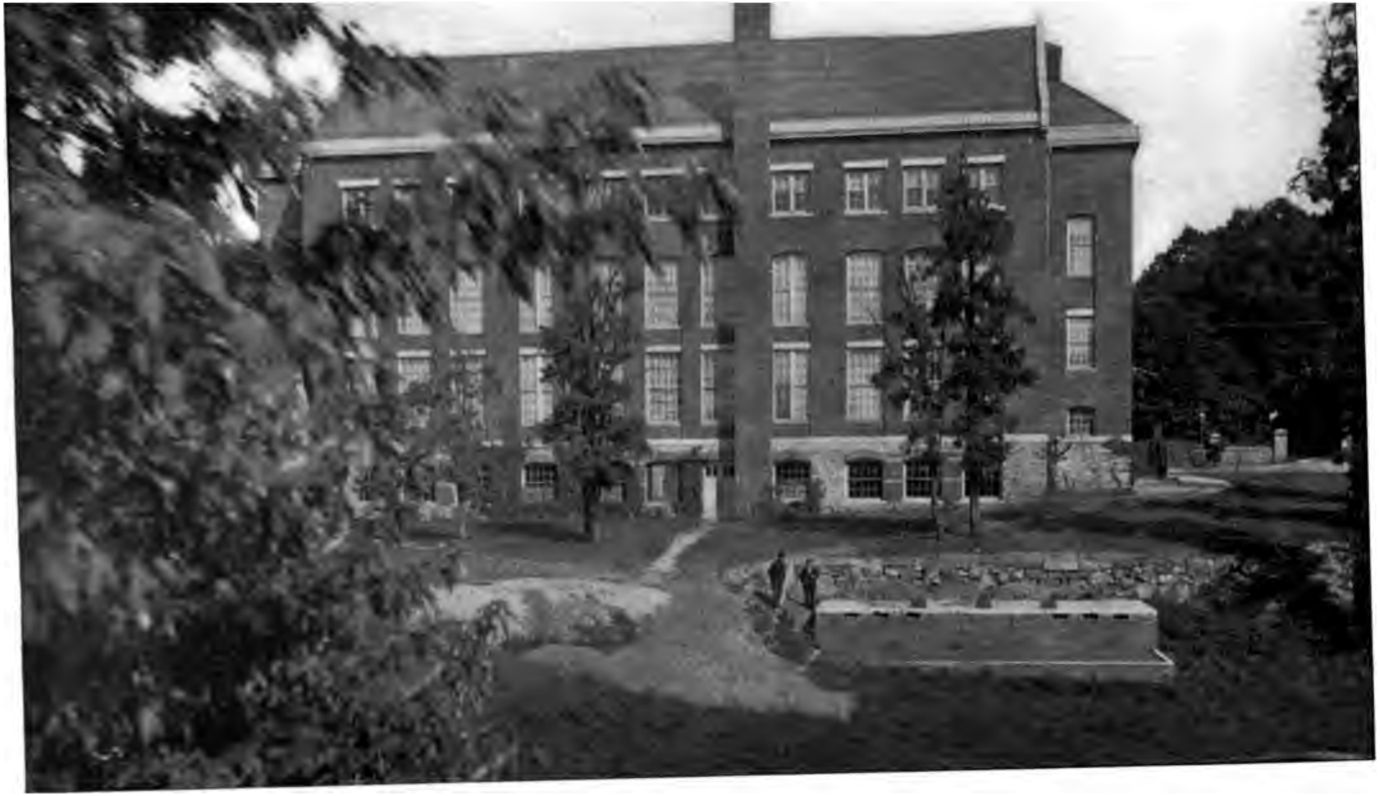
The sewage treated is only that received from the school, th average attendance of which is 500. The school is located on a slight prominence, rendering unnecessary either underdrain o storm systems. At the time of inspection, August 13, 1907, n sewage had been entering the plant for over six weeks and n samples of the effluent were available.

The purification of the sewage is attained by passing the sewage through a tank eight feet eight inches wide, fourteen feet six inches long and eight feet deep; then passing it through one of two contact beds, ten feet eight inches wide, fourteen feet six inches long, and filled with crushed stone of about one inch to 1.5 inches in diameter, to a depth of six feet. From each of these two beds it passes through three rectangular openings in the wall at the surface of the crushed stone each being 1.5 feet long and six inches wide and falls upon the surface of a third contact bed. This bed is 32.66 feet long, about thirteen feet wide and has a depth of crushed stone of about six feet, the crushed stone having the same effective size as that placed in the two beds adjacent to the septic tank and under the same roof. The third bed is unprotected by any roofing.

The septic tank has not been cleaned in four years and had on August 13, at the manholes, a surface scum about two inches



HARRISON, MIRIAM OSBORNE MEMORIAL HOME. SETTLING TANK TO LEFT OF CONTACT BEDS.



Rye Public School No. 3. Settling Tank in Foreground.

thick and an accumulation of three inches of sediment. The rushed rock on the contact bed does not seem to have been cleaned r disturbed since the plant was built some four or five years ago.

The annual operating expenses have been nothing more than the ost of an occasional inspection.

The illustration shows the outside of the tank and its relation to the school.

SARATOGA SPRINGS[1]

The main portion of the village of Saratoga Springs rests on the southeastern slope of the extremity of an easterly spur of the Adirondacks, while the remaining portion of this village lies along the southerly side of the valley of Village brook and spreads out over the sandy plain to the southward.

The natural drainage of the village area is directly into Village brook, which after following a very tortuous course for about three miles discharges into Lonely lake.

The main outfall sewer of the present system is laid in the bottom of the valley, the size of the sewer ranging from fifteen to twenty-four inches in diameter, and discharges into a pump well of 16,000 gallons capacity on the outskirts of the village. The daily flow of sewage is estimated to range from 1,500,000 in the winter, to 2,500,000 in the summer.

The receiving well is 24.5 feet by twelve feet in size, with an effective depth of ten feet. Inside the well are three pump pits, in each of which is a horizontal centrifugal pump set two feet above the floor. The capacity of each of these pumps is 1,000 gallons per minute. The pumps are operated by alternating current motors, starting and stopping automatically through the agency of floats in the pump wells.

The force main from these wells is sixteen inches diameter and 8,835 feet long, the total head pumped against varying from twenty-seven to thirty-seven feet. The force main ends in a chamber and thence through a pipe into one or more of the septic tanks. The tanks are four in number, and have a total capacity of 1,000,000 gallons, each tank being 91.5 feet long, 51.5 feet wide, and a depth of sewage of eight feet. The walls are concrete, about two feet thick, and the floor and roof are groined arches, eleven feet six inches span. There are, therefore, eighteen piers, each eighteen inches square in each tank.

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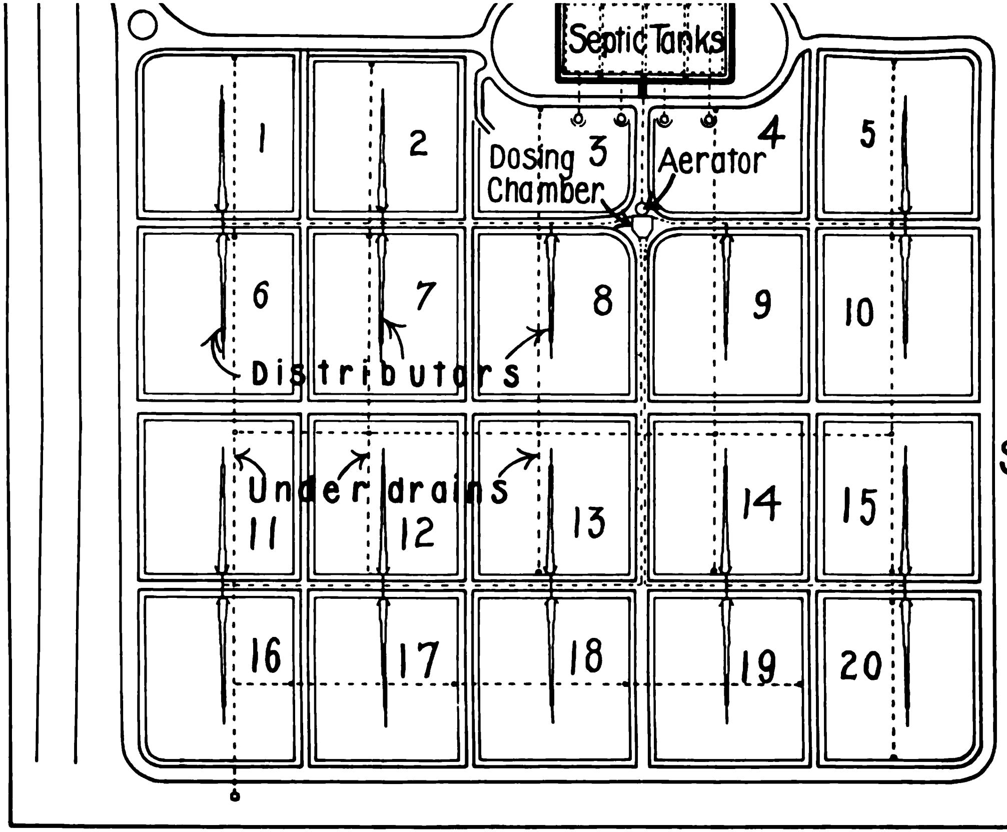
[1] Condensed from article by F. A. Barbour, Ass. Eng. Soc., vol. 34, pp. 4–59.

The sewage enters each tank through four submerged openings, the opening coming midway between the rows of piers. The septic effluent escapes from the tanks through two horizontal rows of a number of two-inch pipe, ninety-six in all, set at an elevation about three and one-half feet below high water line, emptying into a narrow chamber extending the entire width of tank. From this, the sewage flows over a weir into the outlet chambers and thence to the filter beds. A sludge gate is provided for drawing off the sludge and other gates are provided at higher elevations so that the different levels of sewage can be disposed of in various ways when the tanks are cleaned.

Before reaching the filter beds the sewage passes over an aërator of perforated sheet iron plates, hung in three layers around a central riser pipe. This pipe is sixteen inches diameter and is set in a circular well of concrete adjoining the octagonal dosing tank; the combined capacity being 26,000 gallons.

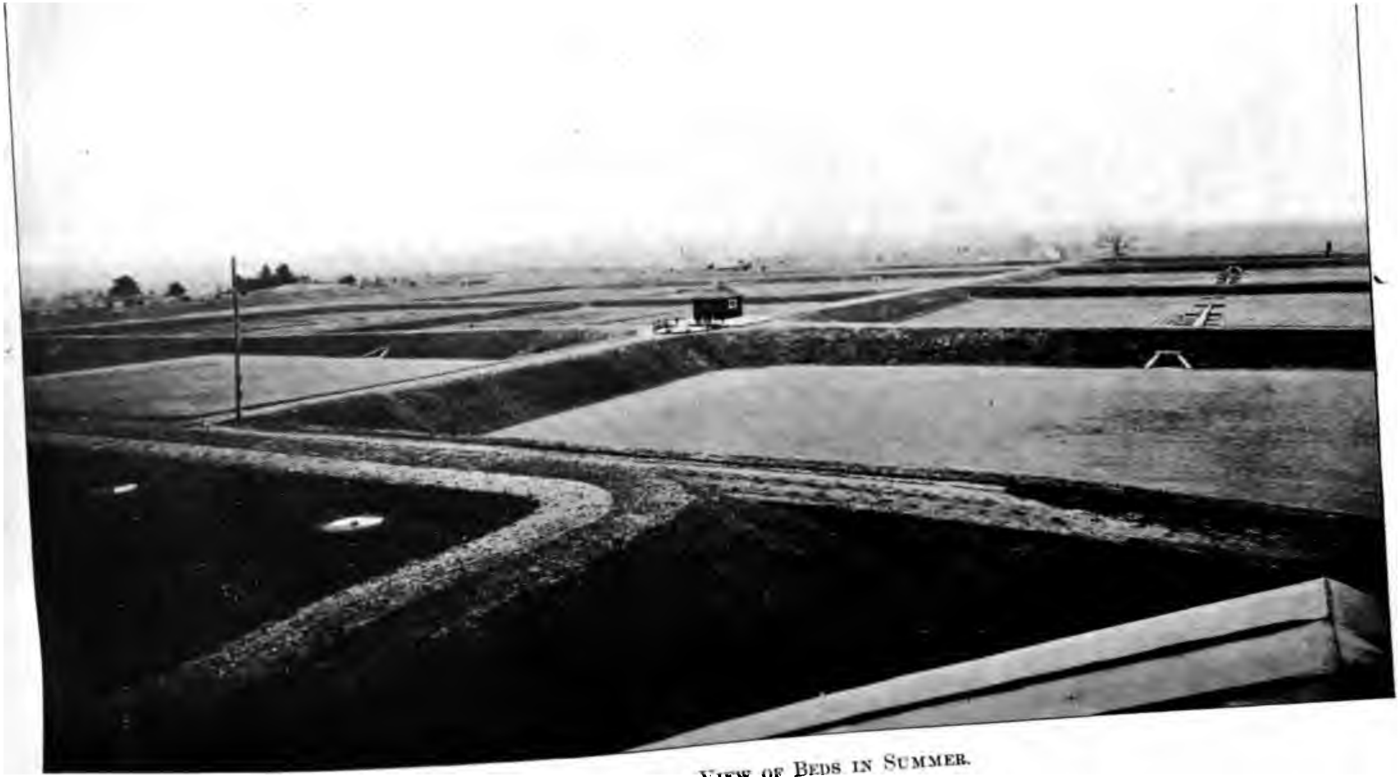
The object of the aërator is to liberate the dissolved gases in the septic effluent, and to allow dissolved oxygen to be taken up. Tests made show a gain of dissolved oxygen from 0 to 70.4 per cent. of saturation before and after passing this aërator.

The dosing chamber, by means of automatic siphons, discharges whenever filled, the intervals depending on the rate at which the chamber is filled. By an ingenious device, the discharge takes place in order through one of four main pipes leading to the filters, a positive rotation of filtering area being thus secured. The main distribution pipes are twenty-four inches diameter and the outlet pipes onto the beds fifteen inches diameter. A wooden carrier extends across each bed from the end of the outlet pipe, these carriers having concrete bottoms and wooden sides. They are five feet wide at the bank and decrease by six inches on each side at four points, in this way slicing off the sewage into ten parts of practically equal amount. The plant was started in July, 1903, and has been most successful. In the septic tank about 65 per cent. of the suspended solids have been removed and the remainder has been so fully comminuted and decomposed as

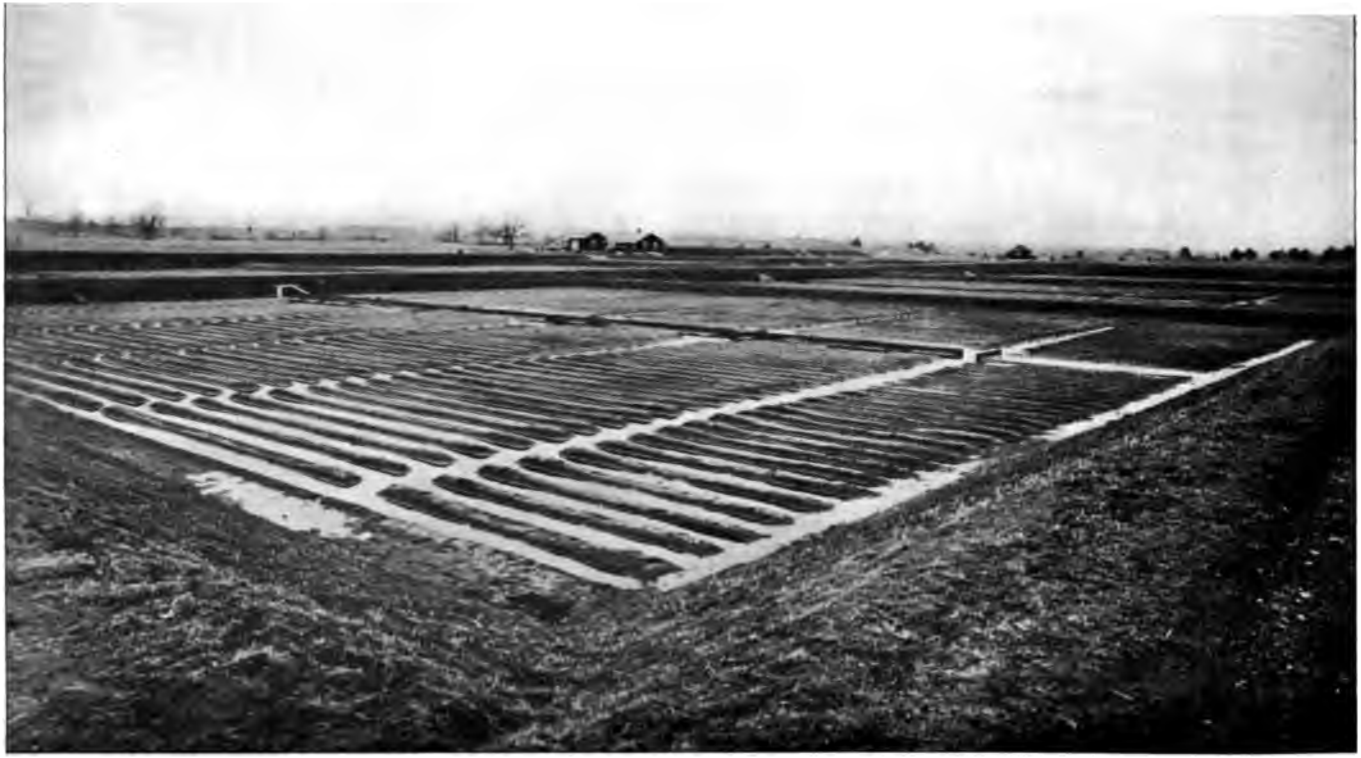


SARATOGA

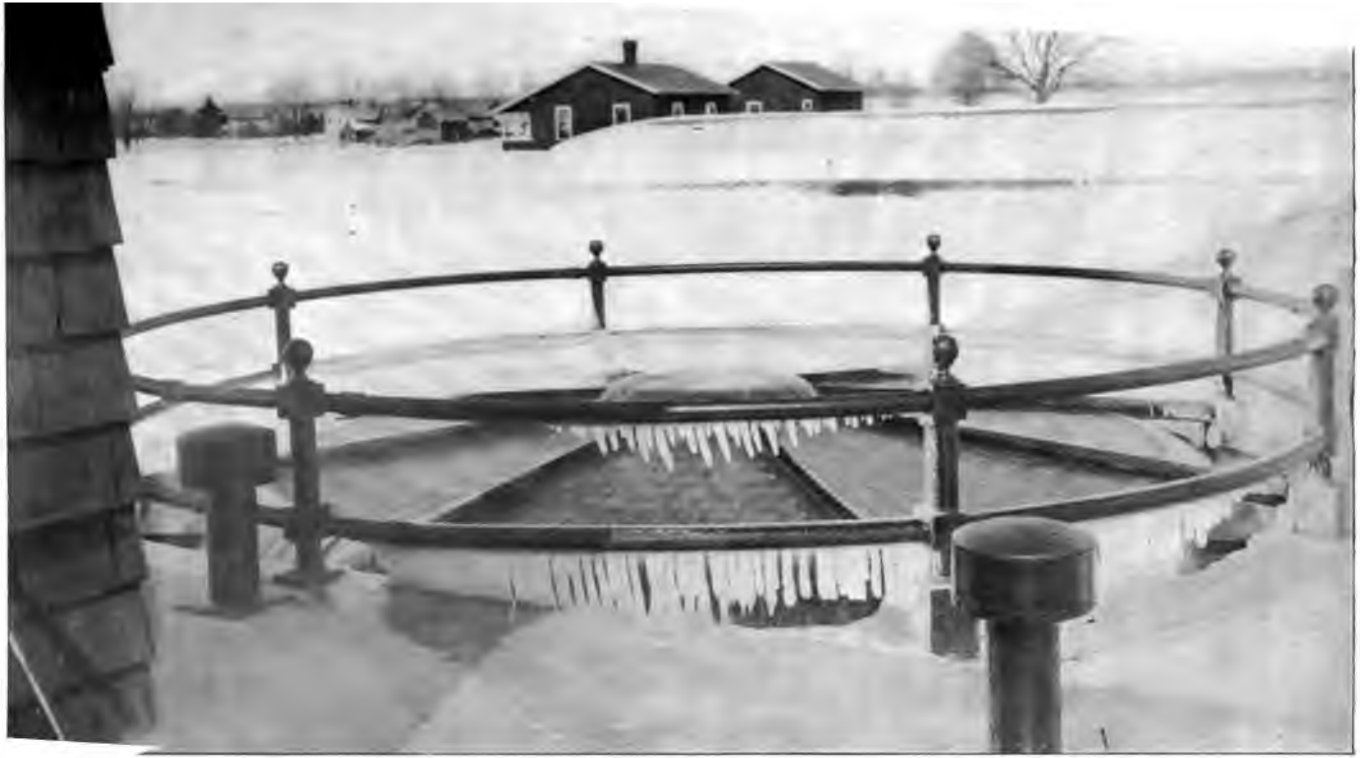
SEPTIC TANK
AND
SAND FILTRATION



Saratoga Springs. View of Beds in Summer.



SARATOGA SPRINGS. VIEW OF BEDS IN WINTER.



Saratoga Springs. Aerator.

nullify its capacity for forming deposits on the filters. Up to e date of Mr. Barbour's paper, January, 1905, the tanks had not en emptied or cleaned, and it then appeared as if the tanks might ntinue to operate indefinitely without drawing off any sludge. e beds are scraped clean of the accumulated scum in the fall d no appearance of clogging is noticeable. The average daily ount of sewage per bed in use is about 140,000 gallons, applied four doses. The entire field is kept in commission and the ds used alternately, so that the average rate per day for the field about 60,000 gallons per acre, a very low rate and one which uld probably be doubled.

The appearance of the beds indicate ample capacity since the nd surface is discolored only near the distributing channels and ows plainly that the sewage passes through only the sand nearest e channel.

The cost of maintaining the disposal field is about $140 a onth, of which two-thirds is expended in turning embankments, eeding drives, and other work independent of the maintenance the bed surfaces. The cost of electric power for pumping has eraged $60 per month and the cost of the attendance adds out $50 per month, so that the total cost of pumping is about ,300 per year, and the entire cost of operating the disposal ant, including the lifting of the sewage and its purification, nounts to about $3,000 per year. Snow & Barbour, of Boston, ass., were the engineers for the plant, which probably represents e best example of a purification plant in this State.

The illustrations show a general view of the plant in winter, a ore comprehensive view of the beds in summer and a detailed iew of the aërator.

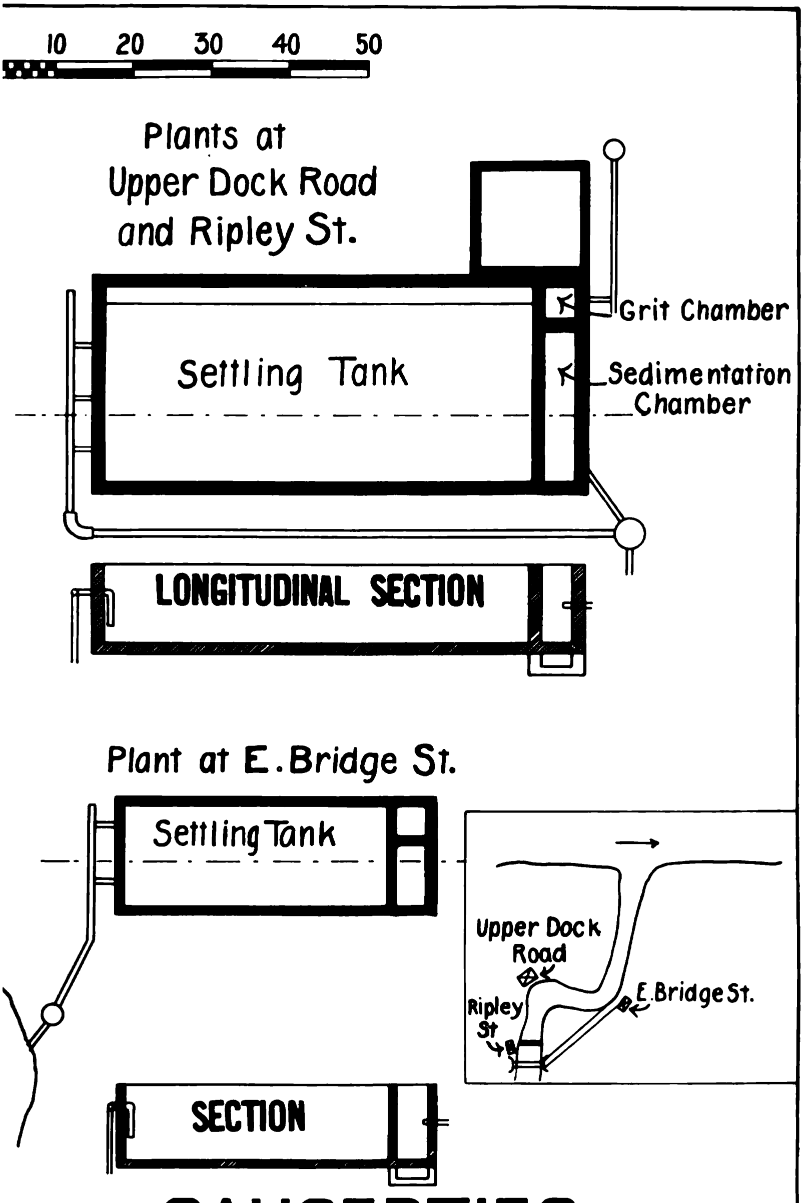
SAUGERTIES

Saugerties is located on the west bank of the Hudson river and as a present population of about 4,000.

The water supply is taken from an area of twelve square miles at is under constant surveillance for pollution of any form. our miles from the city is a reservoir fed by four streams form-g the Platte kill and from this the water feeds to the city by gravity. During dry weather about 60 per cent. of the sup comes from springs on Saxton flats. Practically the total p lation of the city is supplied with water through the 705 con tions that have been made to the system. Nearly sixteen m of pipe, including one mile of sixteen-inch and 5.5 miles of twe inch, are necessary to distribute the water. In 1887 this sys was built by a private company and in 1896 it was bought by village for the sum of $110,000.

The village is built on the banks of Esopus creek, and the regularity of the surface made it necessary to build three sepa sedimentation tanks to care for the sewage. The plants are kn as the "Ripley Street Plant," the "East Bridge Street Pla and the "Upper Dock Road Plant." The Ripley street plan ceives sewage from an area of about three hundred and th three thousandths of the village and a population of 700: East Bridge street plant receives sewage from about one-sixt the area of the village and a population of 400 to 500; and Upper Dock road plant receives sewage from four-tenths to tenths of the area of the village and a population of 800. Ripley street and Upper Dock road plants have the same di sions and all three plants have the same general arrangeme chambers. Work on the disposal plant was begun in 1904 an Ripley street plant and Upper Dock road plant were put in ation in January, 1906. Connections to the East Bridge s system were not made for some time and it has been in use some six weeks to two months. In addition to the three t there are, in the sewerage system, ten miles of vitrified pipe ing from twenty-four inches to six inches in diameter, four m of this being eight-inch pipe; 1,860 feet of cast iron pipe: thirty-one flush tanks, having an average capacity of 365 gal and discharging once in twenty-four hours. About 210 co tions have been made up to the present time, connecting about of the population of the village with the tanks. The se treated is purely domestic, except that during storms, su water enters the system in considerable quantity through f four or forty-five street inlets.

The underdrain system has a length of two miles, one-hal it being four-inch pipe, part of it discharging into the sewers



SAUGERTIES

SETTLING TANK

of it upon an open field on the lower portion of St. Mary's
tery.

. treatment the sewage enters, in each tank, a four feet by
feet grit chamber from which it flows through a six-inch
ing under the wall separating the two chambers into a second
dimentation chamber having the same width and a length of
t feet or 19.5 feet. The wall separating this sedimentation
ber from the main chamber is one foot lower than the wall
unding the grit chamber and acts as a weir over which the
ge flows into the larger chamber. The grit chamber has a
h of about twelve feet while the sedimentation chamber has
pth of about ten feet. The sewage is designed to flow but
the length of the chamber, flowing out through three six-inch
ws and discharging into a ten-inch pipe leading into the
us creek. The Ripley street plant empties into the Esopus
e tank just above a dam and is usually submerged to a depth
ve feet. The outlet of the Upper Dock road plant is sub-
ged about five feet at high tide and is slightly submerged at
tide. The East Bridge street plant outlet is submerged at
tide but is exposed at low tide. In each of the two latter
ts the point of discharge is from 50 to 150 feet from the
. Along one side of each chamber is built a sludge channel
h slopes toward and enters the grit chamber and toward
h the bottom of the tank slopes. At the Upper Dock road
t and at the Ripley street plant the sludge is to be pumped
centrifugal pump but at the East Bridge street plant it will
ecessary to remove the sludge by hand.

sample of the effluent of the Ripley street plant taken from
nanhole into which the effluent discharges showed indications
trescibility in five hours and showed no trace of blue color
enty-two hours. A sample of the effluent from the Upper
plant taken from the manhole near the outlet end of the
chamber showed no indications of putrescibility in seven
No sample of the East Bridge street plant was obtained.
e only item entering into the cost of operation is the re-
l of the sludge and when found necessary to perform this
tion it has been expedited by blowing the sludge directly
the Esopus creek through a "blow out" pipe. Under such

conditions it is difficult to give a fair estimate of annual o expenses.

The total cost of the system was $66,000.

The illustrations show external views of the three sedi tion tanks.

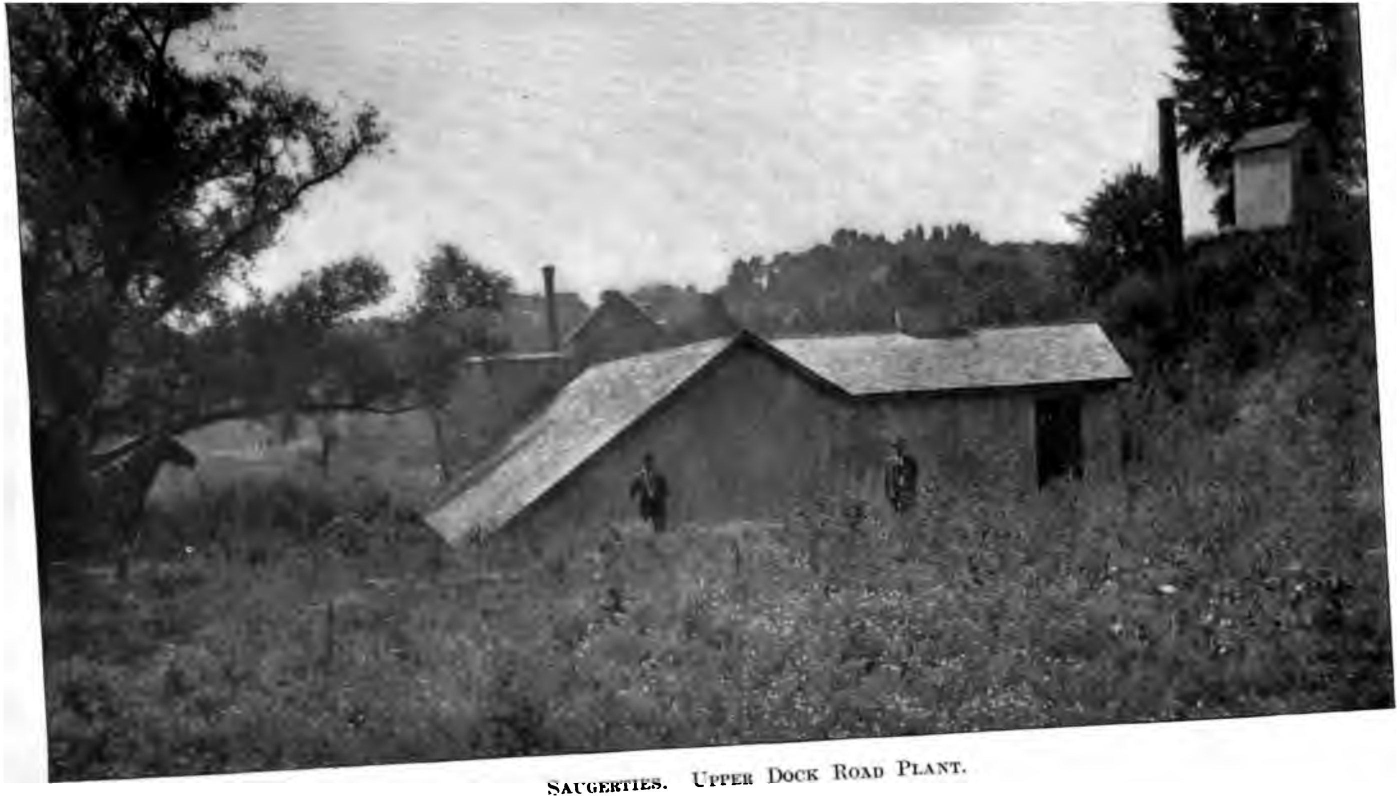
SKANEATELES

Skaneateles village is located at the northern end of Skanea lake and has a population of 1,800. Its drainage is carrie Skaneateles creek to Seneca river.

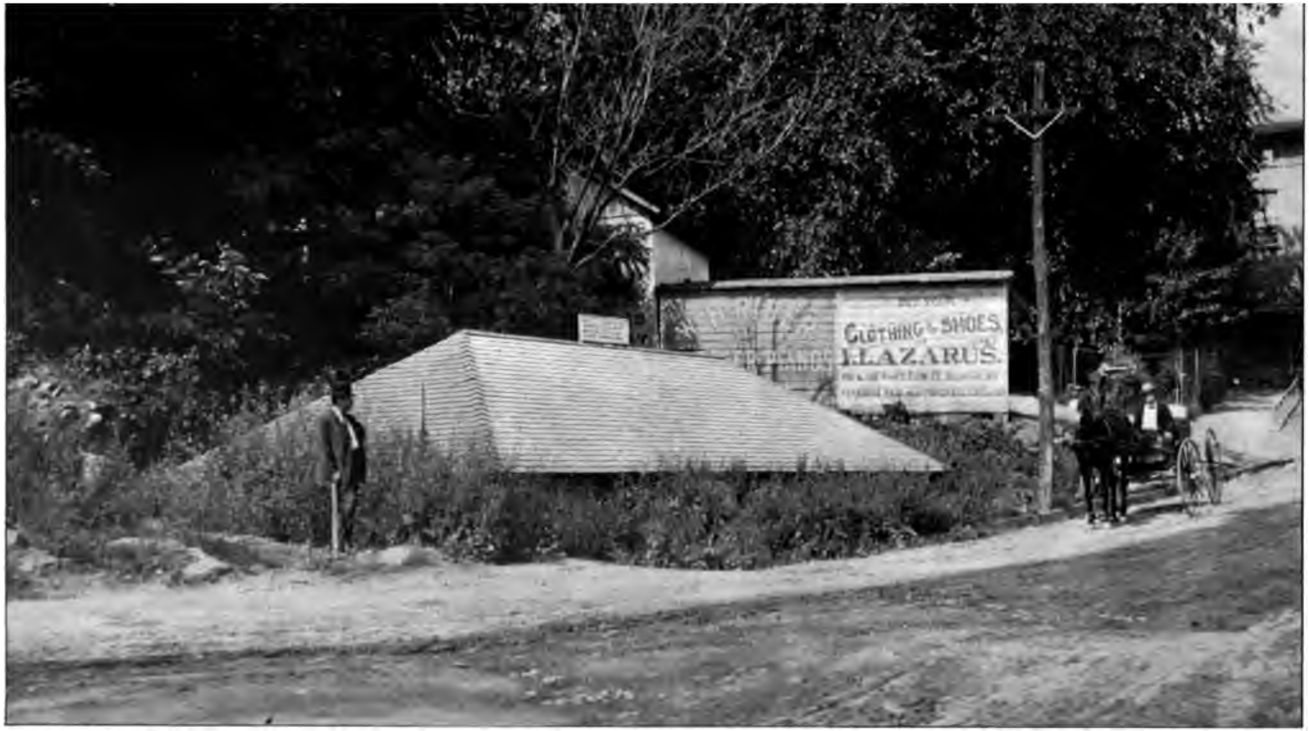
The water supply is taken from Skaneateles lake throug ten-inch wrought iron pipe whose intake is 4,000 feet from shore. The water is pumped into a reservoir having a diam of 104 feet, a depth of 11 feet, a capacity of 550,000 gall and located 1.5 miles northeast of the village at an elevatio 186 feet above the main street. About 200,000 gallons, or gallons per inhabitant, are used daily. An eight-inch iron carries the water from the pump to the reservoir and eight one-half miles of four, six and eight-inch pipe form the di uting system. To this system 320 connections have been including twenty sewer connections, the engine-house a watering trough. The water is good inasmuch as it is taken the same source from which Syracuse derives its suppl whose purity is carefully preserved. Except at rare interv water is very clear.

The sewerage system was completed in the fall of 19 at the present time, cares for the sewage of about 1,400 itants. It has a length of nearly eight miles and approx 280 connections have been made.

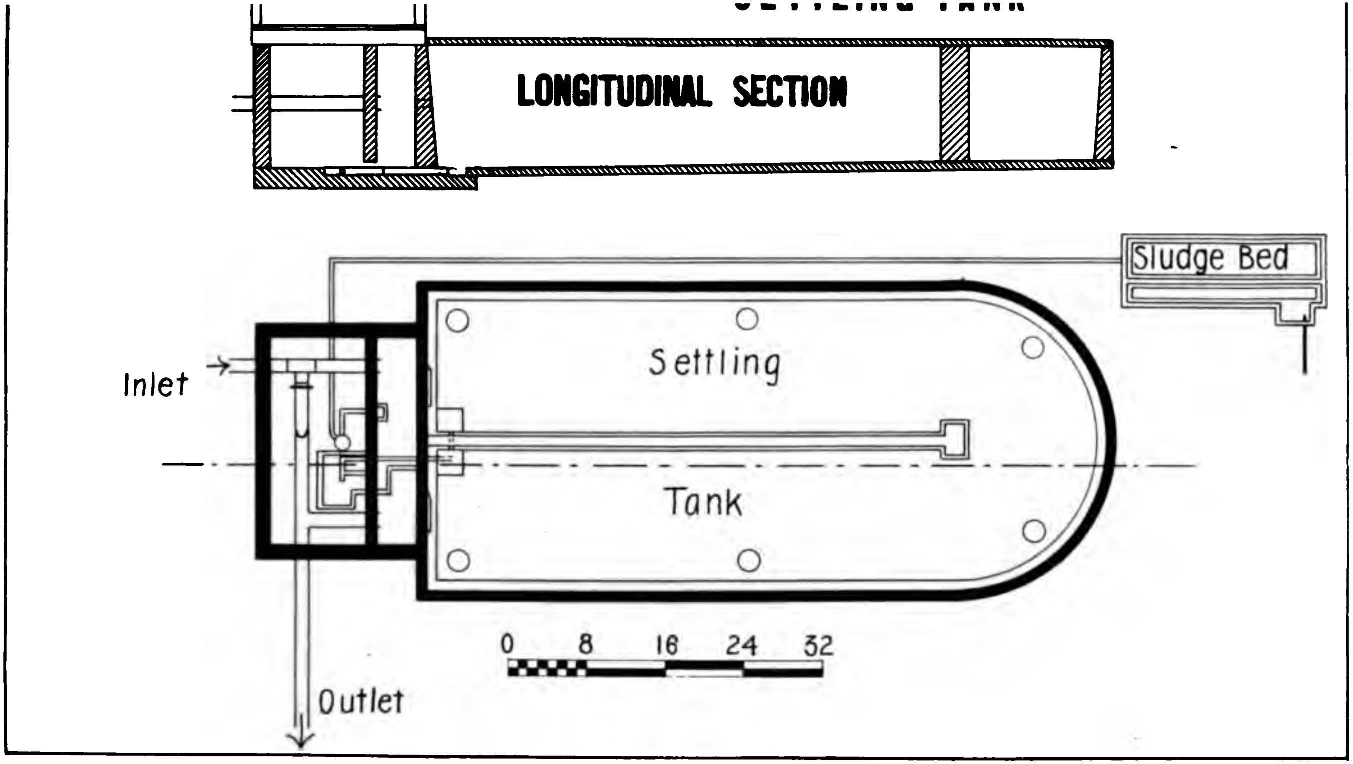
With the exception of three hotels, three churches and flush tanks, all connections are residences and the sewage the system is domestic only. Each flush tank has a dis capacity of 450 gallons and discharges once in twenty-fou the system in this way being flushed. The system is not drained and does not receive storm water in other form ground water.

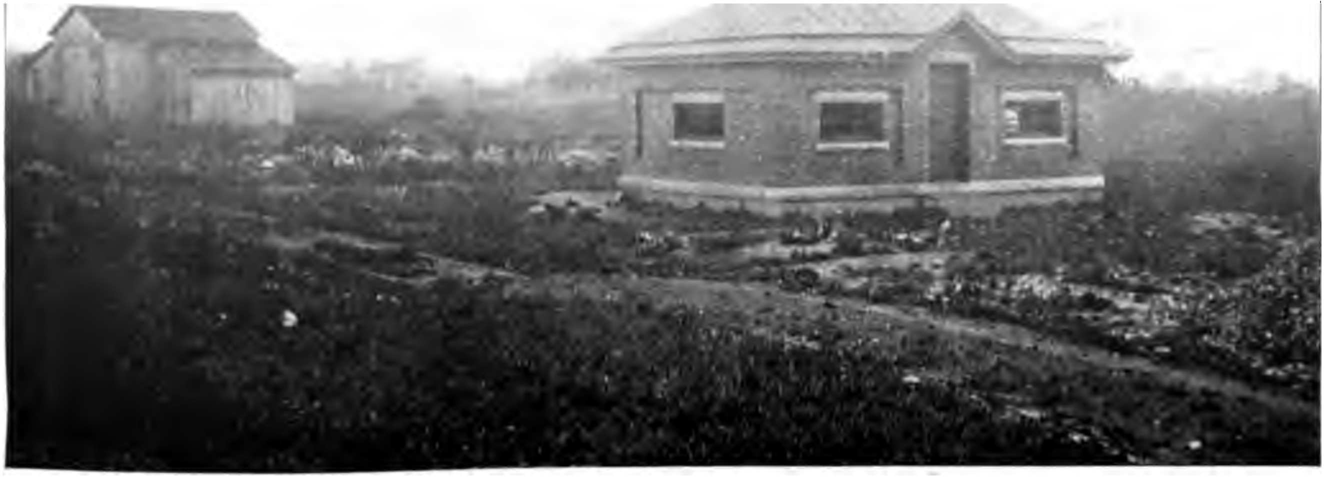


Saugerties. Upper Dock Road Plant.



Saugerties. East Bridge Street Plant.


LONGITUDINAL SECTION
Sludge Bed
Inlet
Settling
Tank
Outlet
0
8
16
24
32



SKANEATELES. SETTLING CHAMBER IN REAR OF BRICK BUILDING.

he sedimentation tank by which purification is accomplished cated at the corner of Elizabeth and Griffin streets on the out- s of the village.

o estimate of the quantity of sewage entering the tank daily d be obtained but it is made very weak by the water furnished he flush tanks and by the ground water entering the system.

he sewage enters the inlet or grit chamber through a fifteen- cast iron pipe and stands at a depth, when running, of six seven inches. From this chamber it flows through two three by one foot openings in the wall separating the grit chamber the settling tank into the latter tank. A twelve-inch wall he middle of the tank causes the sewage to flow around the ide of the tank a distance of about 130 feet. From the ing tank it empties into the outlet or effluent chamber through openings similar to the ones between the inlet chamber and main tank.

wooden baffle placed in the tank near the points of receiving discharging the sewage prevents the disturbance of the sur- in the tank. This baffle projects six inches above the sur- of the sewage and downward to a point three feet from the om of the chamber. On the receiving side of the chamber baffle is vertical but on the discharging side it is inclined, its er edge being seven inches from the chamber wall and its er edge being sixteen inches.

ome twenty feet of fifteen-inch pipe carry the sewage from outlet chamber to Skaneateles creek. No scum was found on ace of the tank. To clean the grit and effluent chambers an trical motor has been installed, by means of which the sewage solid matter is pumped upon a sludge bed eighty feet long, ty feet wide and three feet deep. Near one side of this de- sed earthen bed is placed a ridge of crushed stone two and half feet deep, about two feet wide at the top, and four feet e at the bottom. The liquid matter passes through this wall tone and collects in a rock filled concrete chamber built at the end of the sludge bed and near the creek, and connected to creek with a four-inch pipe. The tanks were cleaned the first r and at that time but one load of waste was removed. This used as fertilizer.

The outlet pipe is about one-half submerged, but the water lev of the creek is nearly constant and there is no danger of wat backing into the plant. Because of the submerged condition the end of the outlet pipe the sample of sewage was taken at t entry into the effluent chamber. This showed putrescibility i less than thirty-six hours though the effluent looked clear and h only a very slight odor.

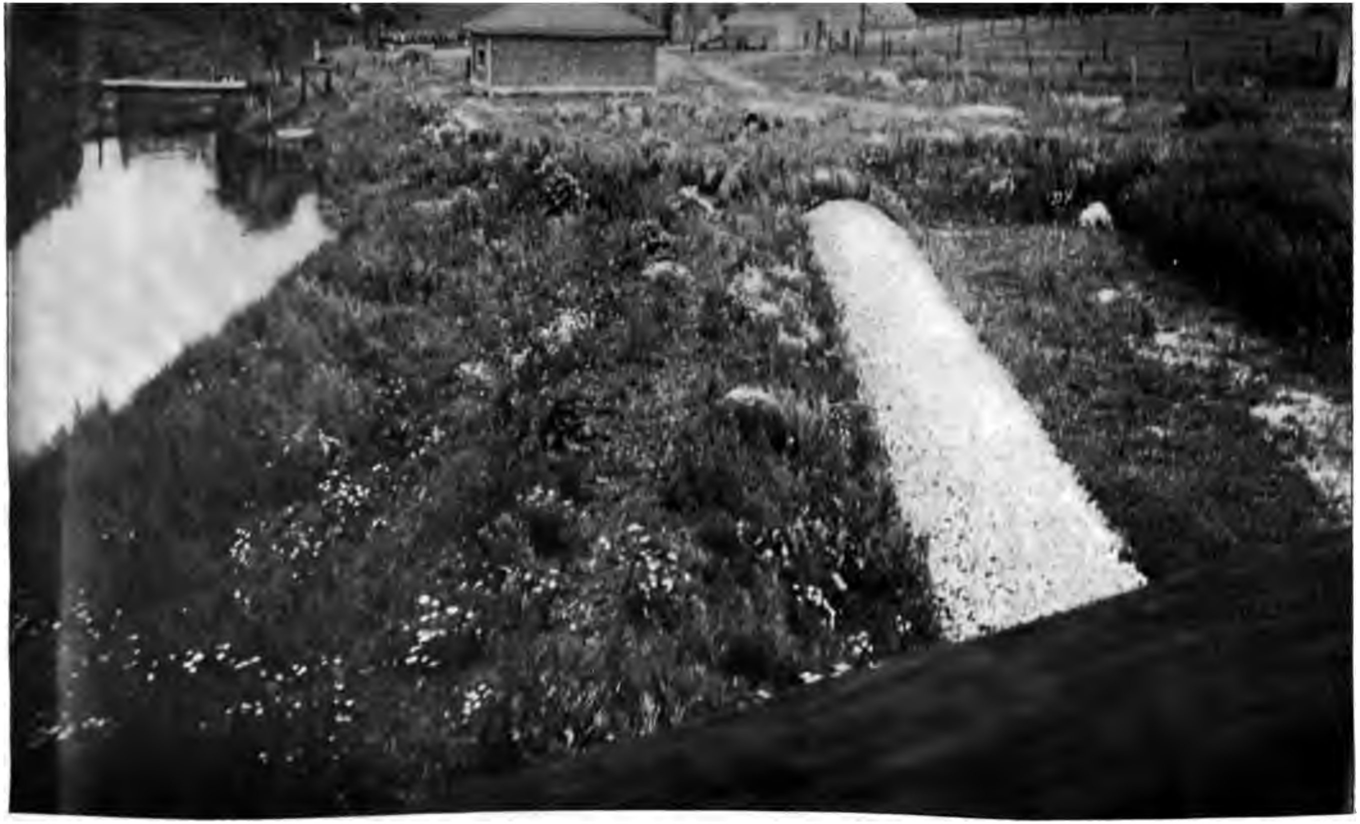
No chemical analyses of the sewage have been made. T plant was designed by H. B. Cleveland, civil engineer, Amst dam, N. Y. The illustrations show the exterior of the buildi from the southeast and the sludge beds and building from t north.

SONYEA

Sonyea village is located on the drainage area of Kishaqu creek, four miles above its confluence with the Canaseraga cree and about six miles from the junction of the Canaseraga cre with the Genesee river. At this place is located the State I stitution or Craig Colony for Epileptics. The population of t village is 300, of the institution 1,250.

The water supply is obtained partly from springs and part from Kishaqua creek, and is pumped by electrical power into storage tank on the western side of the Colony. The spring wat and creek water are kept unmixed, the spring water being pump into a standpipe four feet in diameter and seventy-six feet hig and the creek water into a standpipe fifteen feet in diameter a seventy-five feet high. These tanks are concentric. When t creek water is muddy the spring water only is used; 125,0 gallons of water or 100 gallons per head per day are used. T supply of spring water is good and a new pump of 200,000 ga lons capacity is being installed. About eight miles of water pi have been laid and about seventy buildings have been connect to this distributing system.

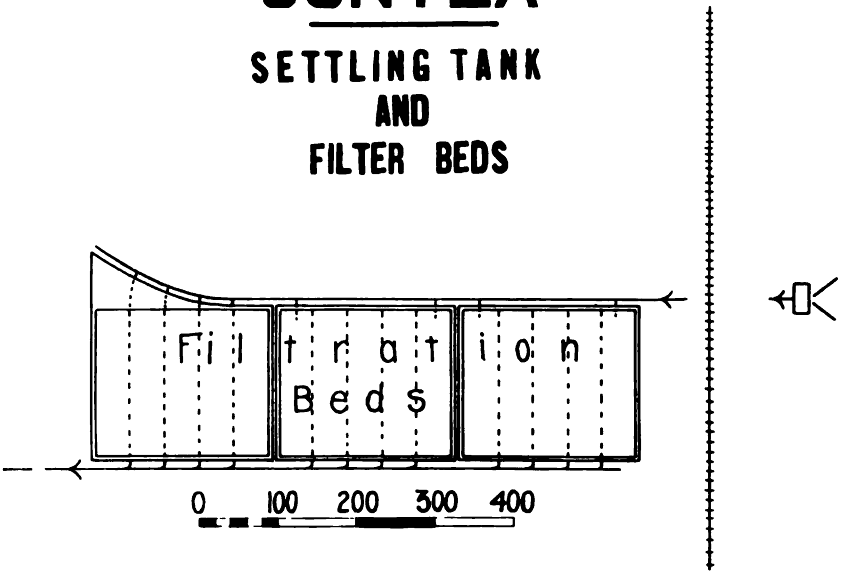
The sewerage system was built in 1896, the method of purifica tion being one of screening and broad irrigation. There a three soil filtration beds, the first being built in 1896, the secon

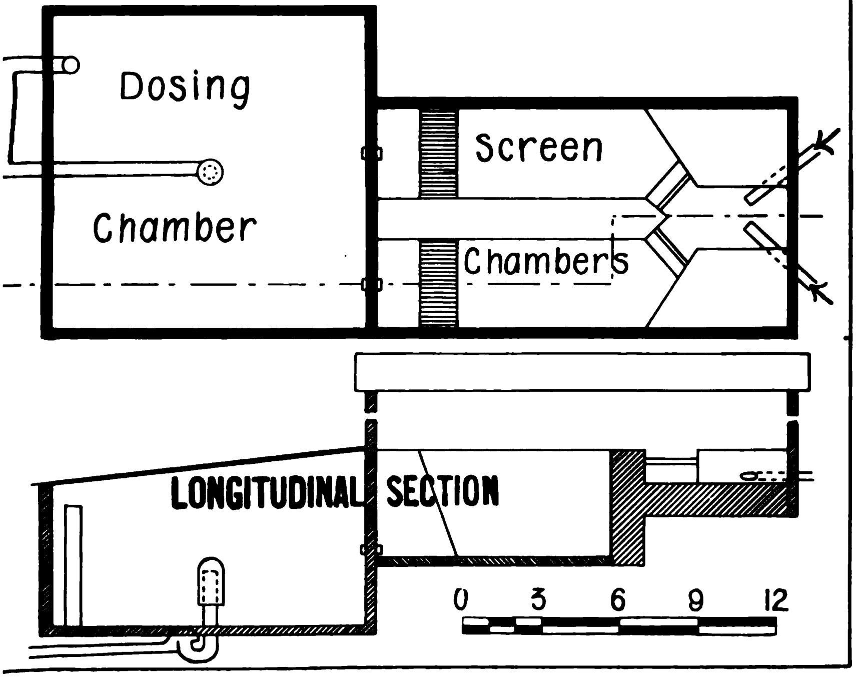


SKANEATELES. SLUDGE BED IN FOREGROUND. OUTLET OF SETTLING TANK AT LEFT OF BRICK BUILDING.

SONYEA

SETTLING TANK
AND
FILTER BEDS





7, and the third in 1905. The three beds have a combined of 698 feet and a width of 200 feet, giving an irrigation f about three and one-tenth acres. Two and one-half miles ver pipe have been laid and of the seventy buildings that een connected to the system, thirty-five are used as dormi- for the patients. A carpenter shop, paint shop, mattress nd bakery have been connected but the sewage is almost ly a domestic one. The population contributing sewage to stem is 1,250, 1,050 of this number being patients of the tion.

sewage enters one of the two screen chambers, the two used alternately and for periods of a week. These cham- re fifteen feet long, four feet wide and near the outlet end h is placed an inclined screen of flat one inch bars, one- r inch thick and spaced three-quarters of an inch on centers. screen retains most of the solid matter in the sewage and end of a week, the period during which the sewage is al- to flow through a receiving or screen chamber, it has ac- ated to a depth of eighteen inches. This fecal matter is d out with pails and buried in an orchard from fifty to eet from the screenhouse, 200 pailfuls being removed at leaning. During the winter the surface of the solid matter screen chamber becomes frozen to a depth of from four inches and from one and one-half to three hours are required n the screen chamber, but during the summer the cleaning mplished in an hour. Five patients of the institution assist tendant at the plant in removing and burying the solid which is taken from the screen chamber.

m the screen chamber the sewage enters the siphon chamber is sunk in the earth adjacent to the screenhouse. The rging capacity of this dosing chamber, which is fourteen quare, is 2,500 gallons and after leaving this chamber the flows through from 550 to 1,200 feet of ten-inch pipe ne of the three soil filtration beds.

soil filter beds are each 200 feet wide, 220 feet long and parated by earth embankments four feet wide on top and a slope of one and one-half horizontally to one vertically. il filtering matter is about three feet deep, its surface is about three feet below the top of the earth embankments separating the beds, and each bed is underdrained with six six-inch underdrains. The sewage flows out upon the beds through a ten-inch tile, is not distributed upon the surface, and is allowed to flow upon a bed continuously for a week. Once in two months a man and team of horses are placed upon the bed and its surface is harrowed, a half day being required to do the harrowing. At the present time, June, 1907, bed number one is being used for the cultivation of corn. The material in the bed varies from loam to stones as large or larger than furnace coal, but the mixture does not form a particularly rocky soil. A disagreeable though not strong odor was encountered at the beds.

From the beds the sewage flows through about one-third of a mile of twelve-inch pipe into the Kishaqua creek. The end of the outlet pipe was but five inches above the water surface of the creek and no provision has been made to prevent the water of the stream from backing up the outlet pipe. At times of heavy rain or the melting of ice and snow the water surface of the creek must be considerably above the bottom of the outlet pipe.

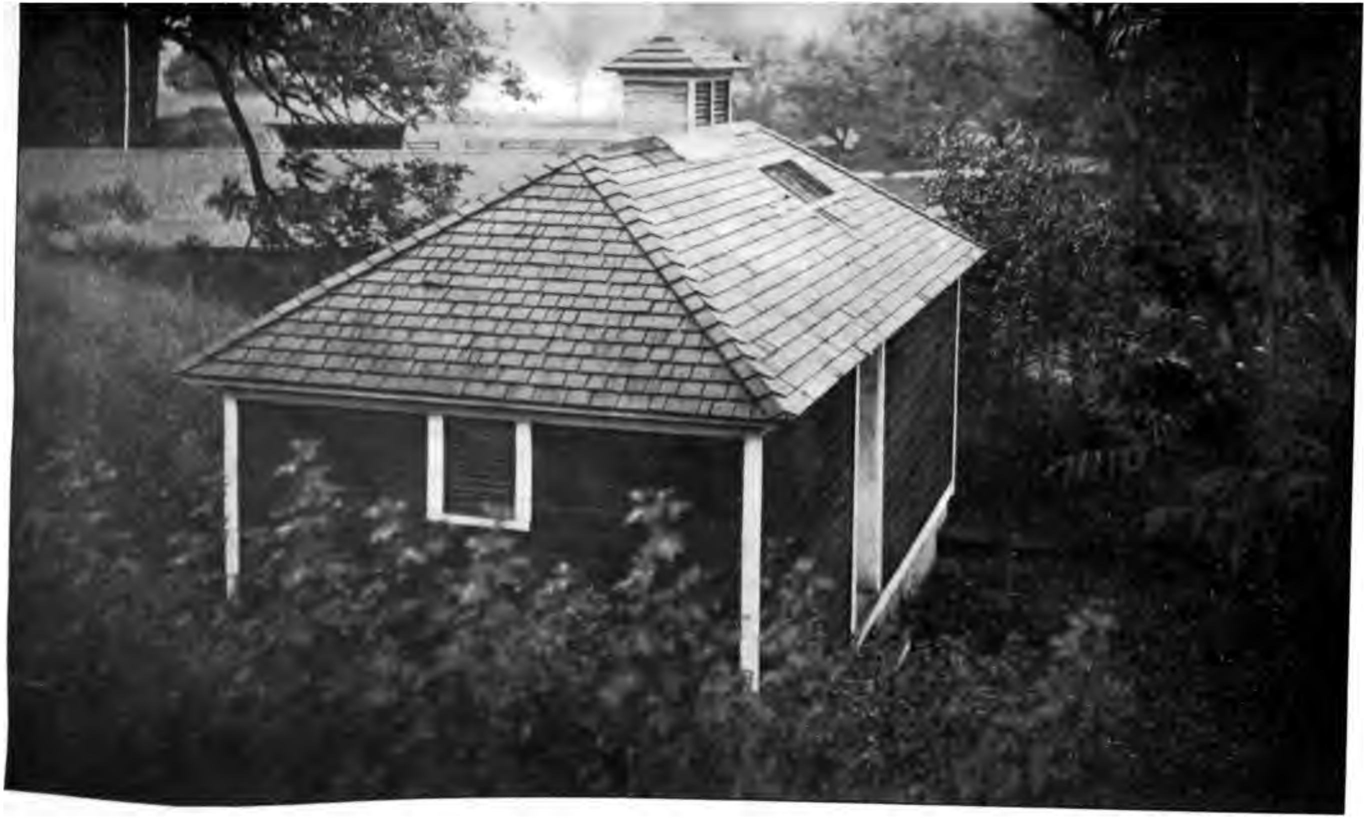
A small amount of sediment was discharged with the effluent and a slight odor was noticeable. Two samples of the effluent showed no indications of putrescibility after eight days.

The illustrations show views of the screenhouse and of the filter beds.

STAMFORD

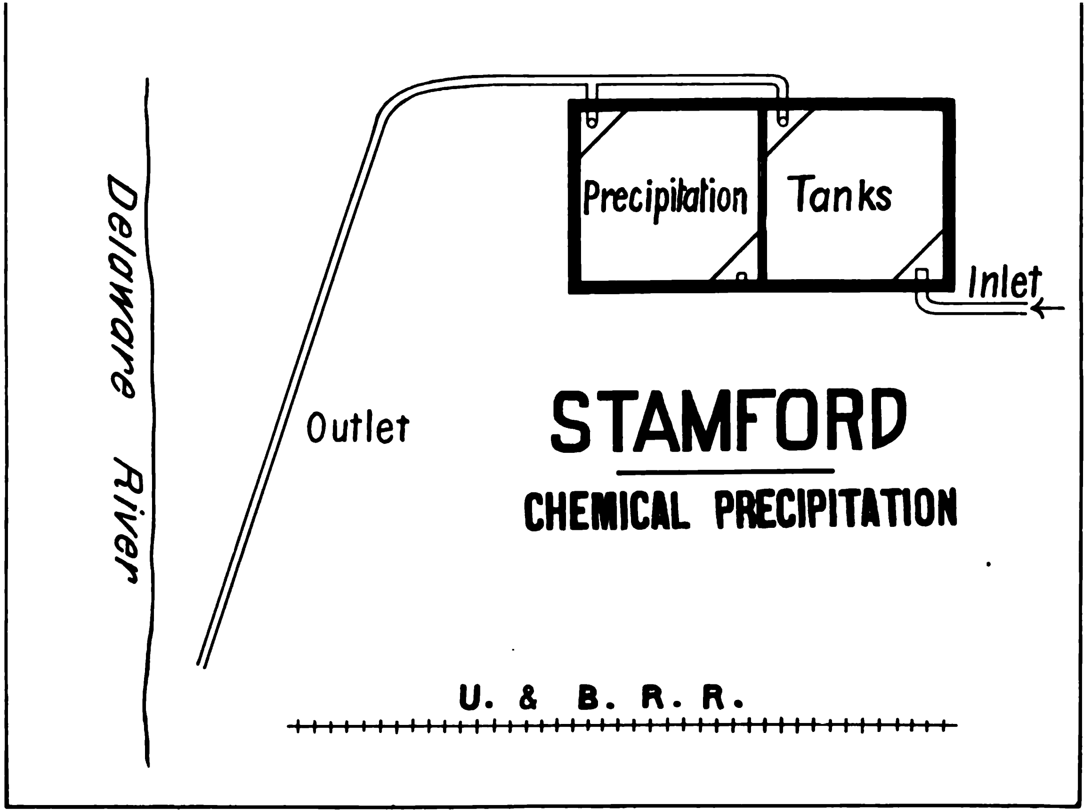
Stamford is situated in the southern Catskill region and has a population of about 1,000, which, during the summer vacation period, at times is increased to 3,000.

The water supply of the village is taken from springs three miles from the village and at the headwaters of the west branch of the Delaware river. The water is collected in a reservoir having an area of five to six acres and a depth of twenty-five feet. The water is supplied at a pressure of from 110 to 115 pounds per square inch. The supply is both pure and ample and has been



SONYEA. SCREEN HOUSE.

Sonyea. Filter Beds.


Delaware River
Outlet
Precipitation
Tanks
Inlet
STAMFORD
CHEMICAL PRECIPITATION
U. & B. R. R.

since 1883. Before being used the water passes through
ral gravel and sand filters.
he sewerage system comprises about 16,000 feet of pipe
ing from twelve-inch to six-inch (largely eight-inch), which
es the sewage to the chemical treatment plant, and 2,500
of effluent pipe required to carry the sewage to the discharg-
oint in the west branch of the Delaware river. Seven flush
s have been built to flush parts of the system.
nfortunately those in authority at Stamford have not felt
sed to furnish much information and the following descrip-
of the treatment of the sewage was gleaned from a visit to
lant the latter part of August, 1907. The chemical treat-
plant consists of two square chambers having an inner side
.5 feet, and a depth of six feet. The sewage may be diverted
ither chamber through an eight-inch channel built in the
f the side wall. From this channel the sewage enters either
ber and passes under a baffle so set that its top is four inches
e, and its bottom twenty-four inches below the sewage sur-
when the sewage is at its discharging depth of 4.5 feet. In
diagonally opposite corner of the chamber from which the
ge enters is placed a vertical six-inch pipe 4.5 feet long and
ecting with the ten-inch outlet pipe. When the sewage
es a depth of 4.5 feet in the chamber it flows over the top
is pipe, which acts as a circular weir, and entering the outlet
finally discharges into the west branch of the Delaware

To prevent floating matter from entering the vertical dis-
ing pipe, a scum board or baffle, similar to the one at the
at which the sewage enters, was placed in the chamber across
orner from one side wall to the other. A 4.5 foot "stop
" permits the sewage to be passed from one chamber
e other. When lime is introduced into the sewage it is
ed directly into the eight-inch channel in the side wall of
hambers and into the chambers themselves. No means are
ded for mixing the lime with the sewage nor is there offered
pportunity of storing lime at the treatment plant, and, judg-
rom appearances, it would seem that the quantity of lime
and the regularity with which it was introduced into the

sewage depended largely upon the regularity with which a of lime was taken to the plant.

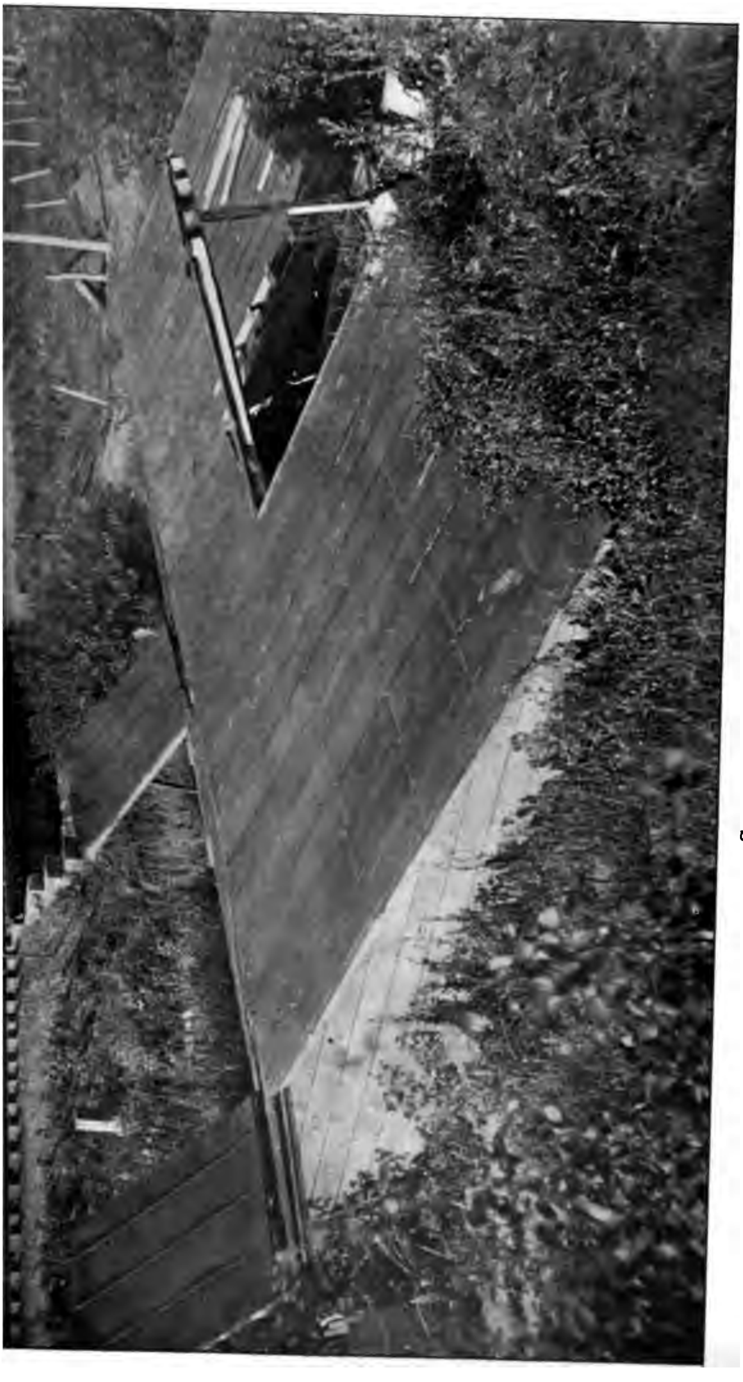
The effluent pipe crosses the Delaware river at the tre plant, then crosses Tanner's pond, and after crossing the twice more finally empties into it at a point about 2,500 fee the plant and apparently far enough away from the vill that an impure sewage effluent would not become a nuis the people of the village. At this point of discharge in river the effluent on August 29 appeared milky, had muc matter in suspension, and left the bed of the stream in sightly condition. Samples of the effluent taken at this showed a loss of the methylene color in less than twe hours.

The illustration shows the roof of the building which the tanks.

THOMPSON RIDGE

The Reid Ice Cream Company of New York has a st collecting and bottling milk at Thompson Ridge. The of the community fearing that the waste wash water f plant, which would be emptied into a small stream through the pastures, would have an injurious effect u cattle, desired the company to treat its waste wash w stead of emptying it directly into the small brook.

"Broad irrigation" on a limited scale was the plan to remedy the condition of affairs. Adjacent to the which is located at the Erie railroad depot, has been built crete chamber eight feet long, six feet wide, five feet de having walls six inches thick. The wash water from the empties into the concrete well, through a six-inch pi accumulates until a depth of about three and five-tenths reached. It is then pumped from the well, and forced th 800 feet of one and five-tenths-inch pipe, to a wooded about thirty feet higher than the pumps. Here it spread the surface of the soil and disappears. The well has a tile overflow pipe leading from it to the brook into whi wash water originally emptied.



STAMFORD. GENERAL VIEW.

TUCKAHOE

ckahoe, situated about a mile north of Bronxville, is ed by the Bronx river. The population of the village is .

ater is supplied by the New Rochelle Water Company. statistics concerning the water supply and water system, ar as they can at present be given, may be found in the re- on the Bronxville disposal plant.

e sewerage system includes 23,000 feet of pipe ranging fifteen inches to eight inches in diameter, most of it being inches, seventeen flush tanks of a capacity of 365 gallons , a settling tank with a maximum daily capacity of 226,000 ns and two contact beds. The sewers are not underdrained. nall storm system having a length of 1,000 feet partly cares the storm water. To this system seventy connections have far been made, connecting about 400 people to the system. e sewage was first allowed to flow in the system June 1, , and connections are now being made as rapidly as possible. total cost of the system was $49,000, $10,000 covering the of settling tank and contact beds, and $39,000 covering the of sewers and engineering services.

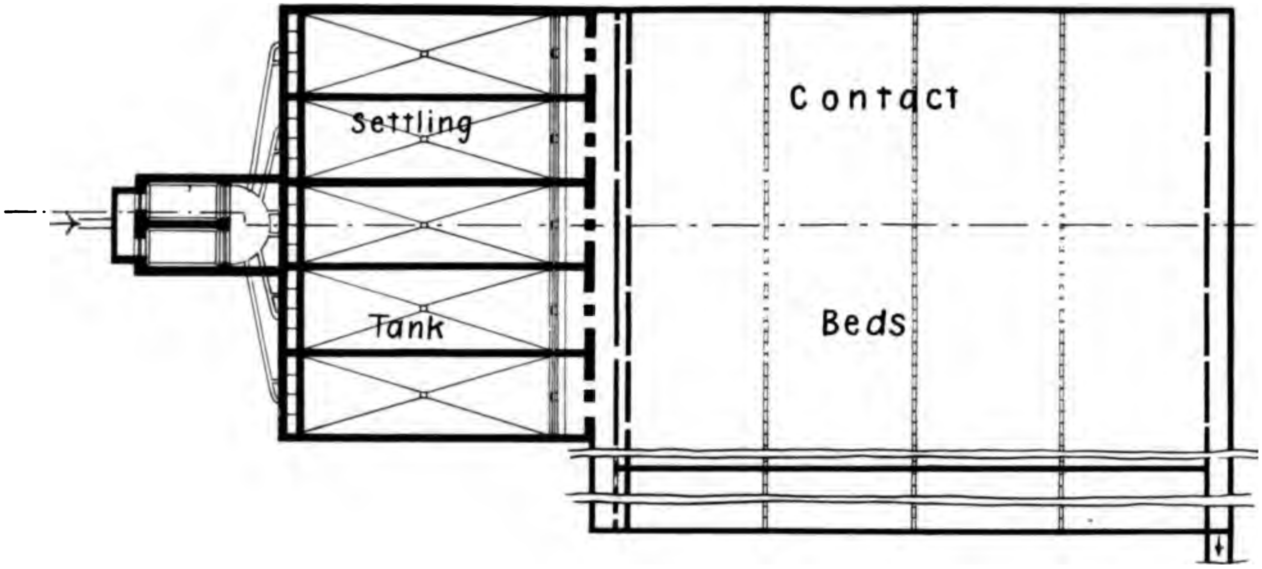
he sewage is very strong, and at the present time is not ted with water from the flush tanks as the tanks have not been metered. Only a small amount of storm water is likely nter the sewerage system, but underground water may enter a much greater extent. Two samples of the effluent taken n the point of discharge of the channel leading from the con- beds on August 9, 1907, showed a loss of the methylene color ix hours. Since September 1, the tests for putrescibility show improvement of 50 per cent.

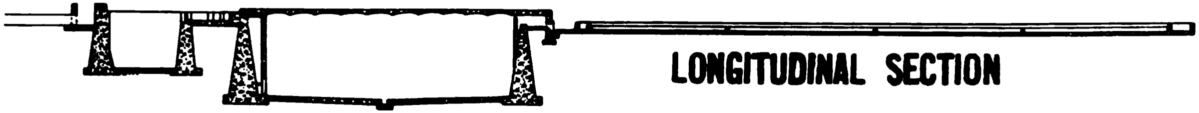
n the process of purification the sewage enters one of two itus chambers five feet wide, fifteen feet long, in which it ects to a depth of slightly more than four feet. From either these chambers it enters a shallow semi-circular chamber ugh which it immediately passes, entering a twelve-inch pipe uced to two ten-inch pipes feeding into some one of the five settling chambers. Once these chambers are filled to a d ing depth the sewage enters the tanks beneath the sewage s A nine-inch concrete baffle wall causes the sewage to d within two feet nine inches of the chamber bottom. The ing forty-four feet nine inches along the chamber it pass a three-inch oak scum board and over a concrete weir inches wide, and a concrete surface three feet four inche From this concrete surface it passes through two openi the chamber wall, discharging below the sewage surface i main carrier extending along the entrance to the two a beds. The tank effluent may be turned upon either or both aeration beds and it may be made to pass through one o of ten gates from the main carrier to the distributing c The main carrier is three feet wide and the distributing ca about one foot six inches wide, and both are perhaps twelve deep. From the distributing carrier the sewage may enter aëration bed through nine gates. Each of the gates men above is a piece of plank, twelve or eight inches wide, one an tenths inches thick and twelve inches deep, sliding in gro the concrete and operated by hand.

The aëration beds are 100 feet square and the crushe varies in depth from nine inches at the inlet end to six at the outlet end. The stone is a clean white marble mi with river gravel and averages about two inches in dia Directly across the path of flow of sewage and twenty-fi apart have been placed three rows of brick, the brick resti their side, which retard the flow of sewage through the ae beds. From the aëration beds the sewage enters an e channel, similar to the main carrier, through which it flow the Bronx river about thirty feet from the aeration bed What it would cost annually to operate the plant cann very well estimated as the plant has been in operation for a time only. What solid matter has been removed has be moved by hand and buried near the chamber but in the of cleaning the chamber the solid matter is to be remov pumping.

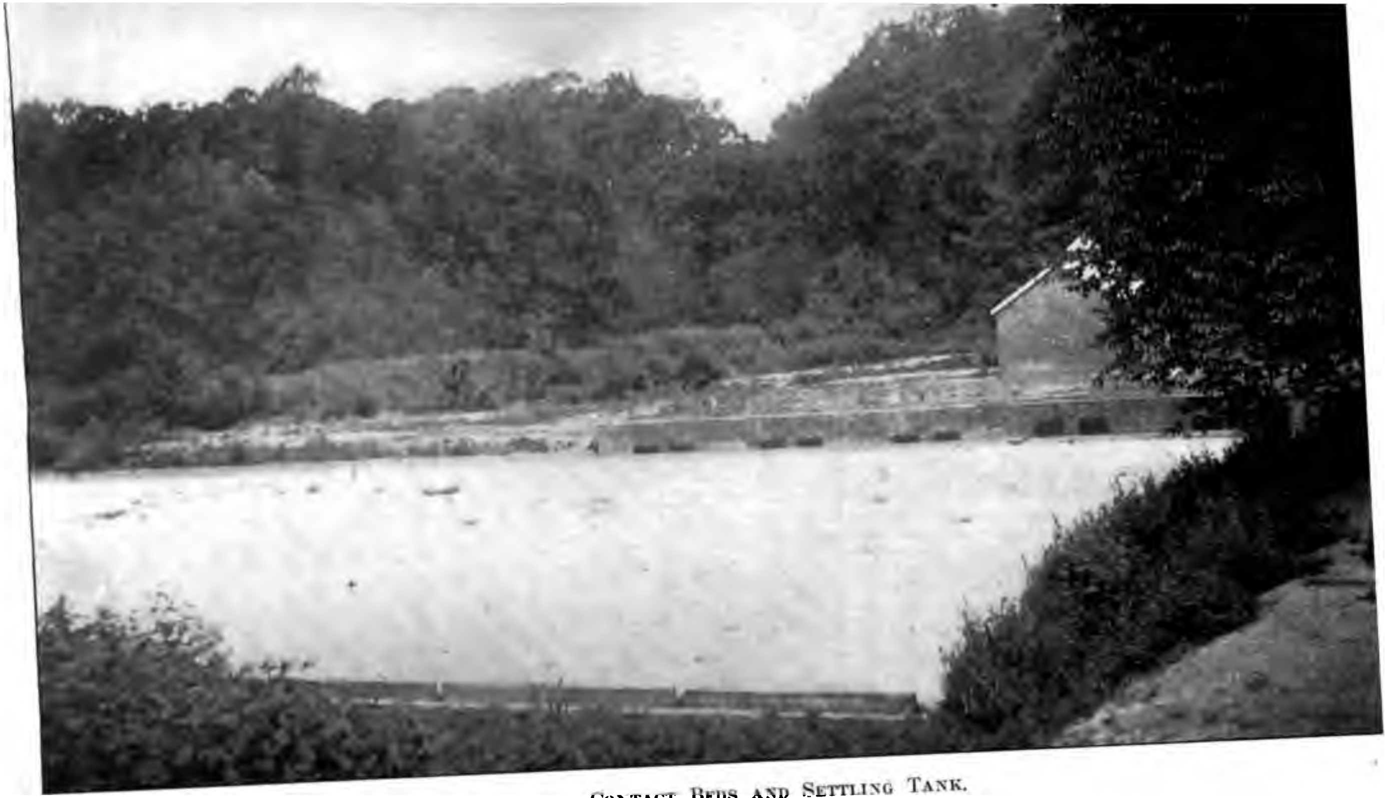
The illustration shows a view of the contact beds, l toward the settling chamber.

SETTLING TANK AND CONTACT BEDS

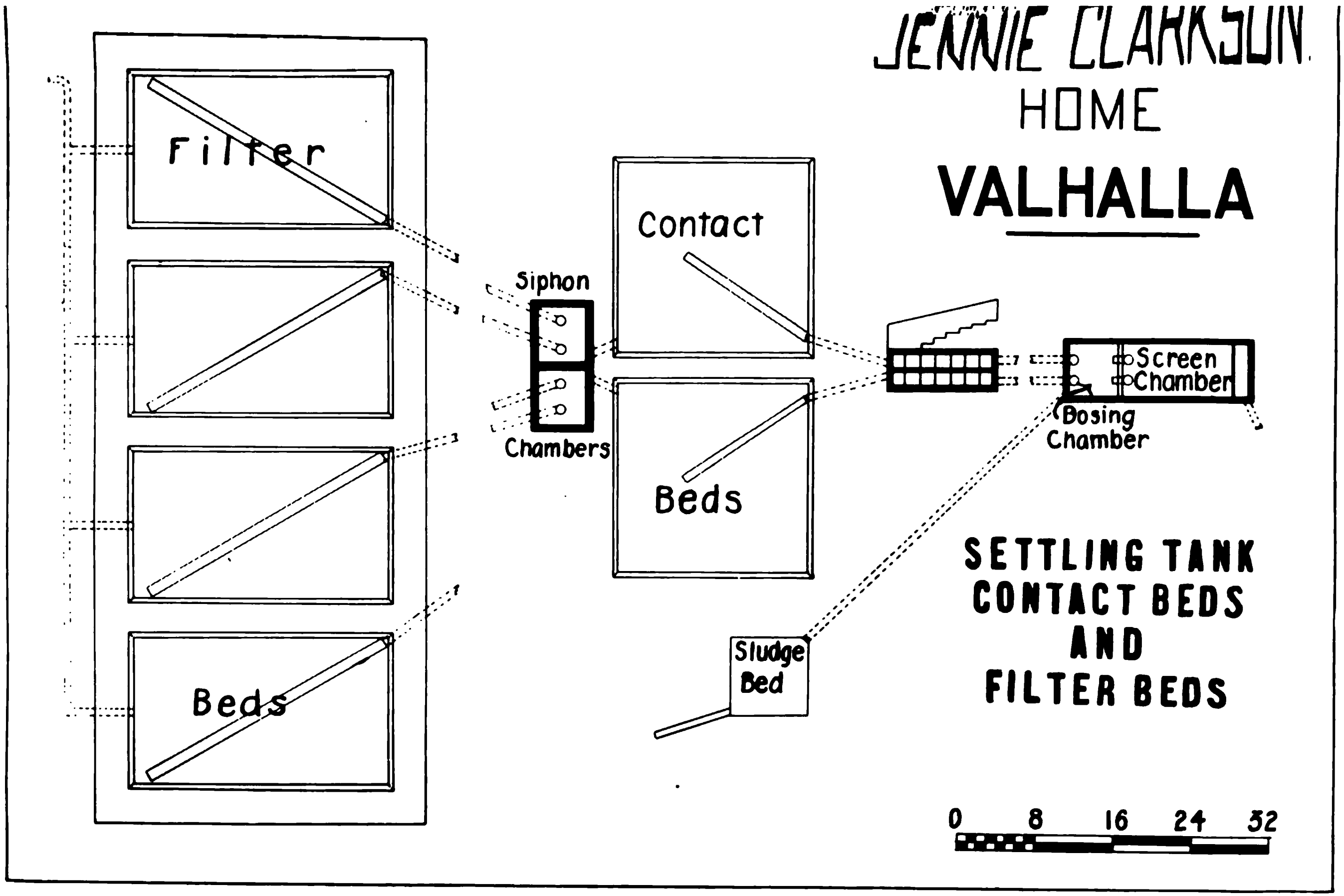




LONGITUDINAL SECTION



Tuckahoe. Contact Beds and Settling Tank.


JENNIE CLARKSON HOME
VALHALLA
Filter
Beds
Siphon
Chambers
Contact
Beds
Screen
Chamber
Bosing
Chamber
Sludge
Bed
SETTLING TANK
CONTACT BEDS
AND
FILTER BEDS
0 8 16 24 32

JENNIE CLARKSON HOME, VALHALLA

he Jennie Clarkson Home for Orphans is situated about mid- between Kensico and Valhalla on the east shore of the small forming the headwaters of the Bronx river. The present ulation, August 8, 1907, is about thirty.

he water supply of the institution is pumped from a well ty-two feet deep and into a reservoir 100 feet distant and ing a capacity of 50,000 gallons. From this point it is con- d by gravity to the building 700 feet distant through a three- pipe.

he sewerage system contains about 400 feet of pipe, the ing tank and the contact and filter beds. It was built during summer of 1906, but was not put into operation until about 1st of July, 1907.

he sewage is domestic only and is rather weak. On the date nspection the flow of about 1,200 gallons was so small that no ent came from the lower or filter beds, the sewage either porating or disappearing in the soil. No test for putresci- ty of effluent from the settling chamber was made.

n undergoing treatment the sewage enters the grit chamber, feet wide, six and five-tenths feet long and six and five-tenths t deep, through an eight-inch tile pipe and from this it flows ler a wooden baffle extending about twelve inches below the face of the sewage. It then enters the settling chamber, en feet long, six and five-tenths feet wide and six feet deep. sewage in the chamber was covered with a thin soapy film had a depth of four feet. From the chamber it passes into siphon or dosing chamber in which have been placed two -inch siphons, discharging the sewage upon one of two con- aërating stairs. The discharging depth of this chamber is n inches. The stairs contain six steps four to five inches one and five-tenths feet wide and two feet long. From the end of each of these stairs and not guarded by a valve d eight feet of eight-inch tile which convey the sewage to et beds, one for each set of aërating stairs. These contact are filled to a depth of about four feet with slag of the size urnace coal or slightly larger, from the Columbia Iron

Works, Copake, N. Y. The beds are twenty feet s upon the surface have been placed wooden distributors deep, twelve inches wide and fifteen feet long. The each trough is covered with concrete and at interval inches along the side have been made seventy-fivehund holes to allow the sewage to flow upon the beds. As working, the sewage flows from these beds in less than f utes after the siphon of the chamber ceases to flow. beds the sewage enters a second set of siphon chamber taining two siphons similar to those in the dosing cha tank and through which the sewage flows upon four sand fifteen feet wide, thirty feet long and filled with sand of three feet six inches. On the surface of each i wooden trough distributor twenty-eight feet long, one and nine inches deep. At the outlet end of these been laid eight-inch tile all leading to a single eig which discharges upon the meadow about 150 feet fro beds.

In the event of cleaning the settling chamber the s through about sixty feet of pipe upon a sludge bed square and filled with slag to a depth of about three effluent from this bed feeds upon the meadow throug inch pipe about eight feet long.

The plant has not been in operation but a month a mate of the cost of operation can be given. The con of the total sewerage system was $2,310.18.

The illustration shows a general view from the se across the plant.

WHITE PLAINS

White Plains is located in the south central part of county on the drainage area of the Bronx river. The is estimated at 13,000.

The water used is taken from five caisson wells. O four are twenty-five feet in diameter and twenty-five the fifth being fourteen feet in diameter and sevente These wells are from one to one and one-fourth miles d

Valhalla, Jennie Clarkson Memorial Home. Point of Discharge Shown by Flag in Background.

ffice of the water commission and are located in a marsh on
ortheast side of the village. The present storage capacity
,000,000 gallons, but a new reservoir, when completed, will
sh 125,000,000 gallons additional. The water collects in
ive wells and from these it is drawn through 1,500 feet of
to the pumps. From the pumps it is delivered directly to
onsumers at an average pressure of about eighty pounds. A
pipe receives what water may be pumped in excess of the
nd. There are about thirty-three miles of water pipe in the
m, ranging from fourteen inches to seventy-five hundredths
inch, most of it, however, being six-inch pipe. The system
een in use twenty years and since September 1, 1897, has
owned by the city. About 2,000 connections have been made
e system and the daily consumption of water is about 475,000
ns.

e sewerage system was started about fourteen years ago and
des at present approximately twenty miles of pipe, ranging
twenty-four inches to eight inches in diameter; fifty auto-
c flush tanks each having a capacity of about 360 gallons
so regulated as to flush four or five times daily; a pumping
on or "injector" at Westchester avenue and North street
h lifts from 132,000 gallons of sewage in dry weather to
000 gallons in wet weather from that part of the city which
w to a point such that its sewage can be fed by gravity to the
fication plant; and the purification plant. To the system
less than 2,000 connections have been made, connecting a
lation of 13,000 to 14,000. The system is partly under-
ed, the underdrains having a length of three and five-tenth
s and discharging into Davis brook.

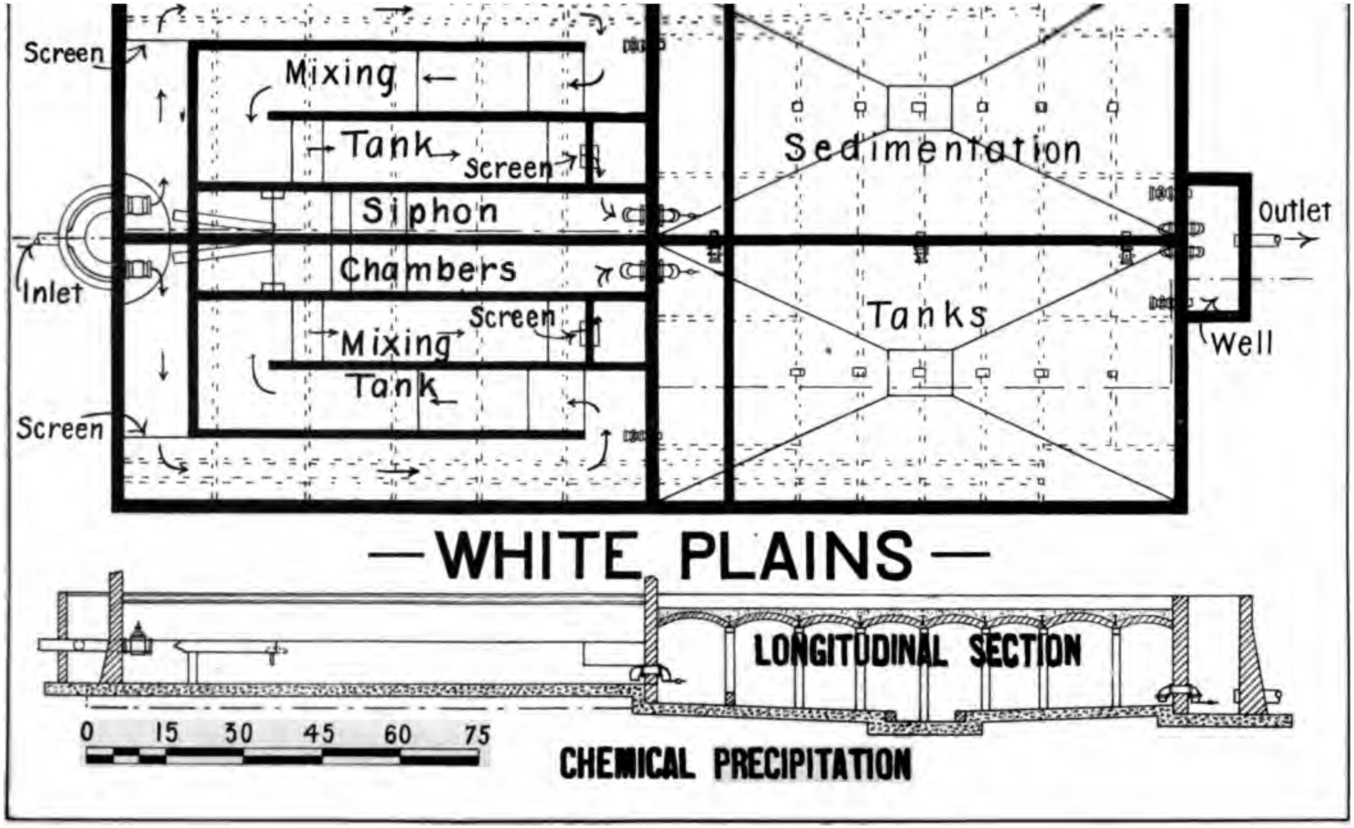
he sewage is not mingled with storm water or manufacturing
es of any kind. From the increased pumping necessary at
'injector" works during wet weather it appears that a con-
able quantity of ground water enters the system. The total
was estimated at figures varying widely, but it is quite prob-
that the flow often exceeds and about averages 850,000 gal-

The effluent from the purification plant passes through
) feet of pipe before it empties into the Bronx river. At
point the bed of the stream is covered with sediment from the

sewage, which gives the water of the stream a milky appear
The odors in the vicinity of the point of discharge on the d
inspection were not very offensive, but the conditions a
point seemed particularly favorable to mosquito life.

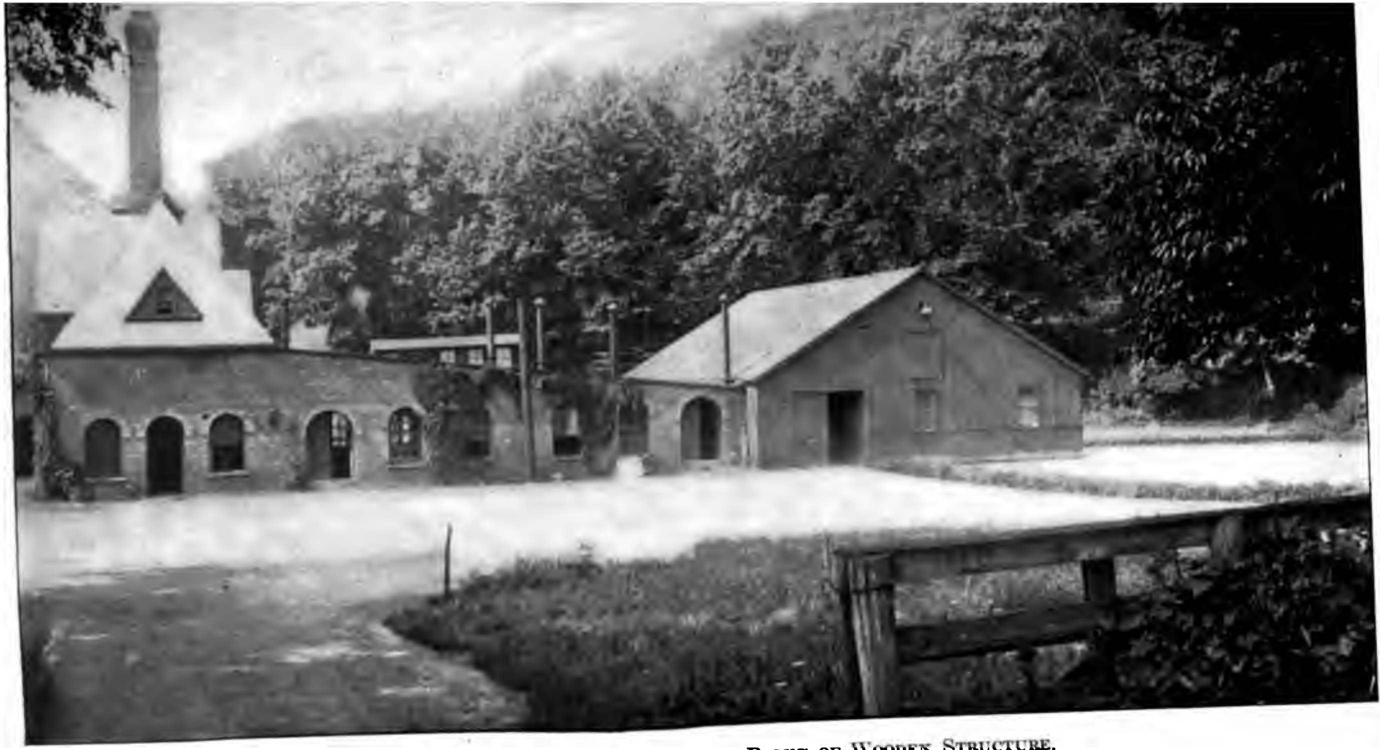
As it undergoes treatment the sewage is mingled with
iron and with the results of the combination of sulphuric
common salt and managese dioxide. The plant is arranged i
separate parts so that one part is in use while the other is
cleaned. As the sewage enters the plant it passes thro
screen of vertical iron bars one hundred and twenty-five
sandths of an inch thick, five-tenths of an inch wide, fou
long and spaced one inch center to center. At this screen a
stream of milk of lime and another of iron is poured in
sewage. From this point it flows from 185 to 200 feet, cha
its course three times and passing through a second screen
tenths inch mesh and under two baffle boards reaching eight
below the surface of the sewage and four inches above the s
In leaving the sedimentation passages the sewage is compe
flow under a metallic baffle which reaches to within ei
inches of the bottom of the chamber and which projects son
or five inches above the surface. This baffle completely sur
the rectangular opening in the wall through which the
flows in passing into the siphon chamber. From this
chamber it passes into a sedimentation chamber forty-fi
long and twenty-four feet wide, from which it again sipho
a well and then passes into the effluent pipe and into the
river.

Between five and six barrels of lime are used daily
placed in one of the two iron troughs provided for that
These troughs are two feet deep, eighteen inches wide an
eight feet long. Along the bottom of the troughs is laid a
five hundredths-inch pipe having perforations about eigh
apart, through which water is constantly pumped from th
river into the trough. The water is pumped through a
five hundredths-inch outlet with thirty pounds to forty
pressure, and this insures a constant mixing and disturban
water and lime. The iron solution is mixed in an iron vat
1,800 gallons. The amount of iron used varies, but freq



— WHITE PLAINS —

CHEMICAL PRECIPITATION



WHITE PLAINS. SLUDGE BEDS AT RIGHT OF WOODEN STRUCTURE.

boy is used daily. This iron solution is agitated by blowing
through it and is fed into the sewage through a small five-
ths-inch pipe at the same point that the lime is fed into it.
ce a week, on the day previous to cleaning the sediment from
chambers, the sediment is treated with chlorine. This is
pared by mixing in a lead-lined iron chest a pailful of man-
nese dioxide, a pailful of common salt and from five-tenths to
ull carboy of oil of vitriol. A glass water-gauge indicates the
ssure in the chlorine generator and enough acid is added to
duce a given pressure. As soon as the pressure is reached a
ve is opened and the gas formed is fed into the tanks to be
aned through two-inch lead pipes perforated with twenty-five
hundred-inch holes spaced about twelve inches and fastened
the sides of the sedimentation chambers and about six inches
ve the bottoms of the same.

The solid matter is pumped from the chambers each week upon
dge beds adjacent to the building. There are two of these
ls of about the same size and having a combined area of about
00 square feet, or slightly more than eight hundredths of an
e. The sludge at each cleaning accumulates to a depth of
ee inches and is left on the beds until dry enough to be winved,
which is usually seven days. It is then put in winrows to
ten the drying, and as soon as it can be removed it is wheeled
a point near the sludge beds. About thirty-five yards are re-
ved at each cleaning. Only a small amount of this is used as
tilizer, most of it being left on a pile at the plant. The bottom
of the beds is covered with ten inches of sand, which gradually
appears with the continued cleanings.

The annual cost of operation:

st of running "injector" at Westchester avenue and North street	$3,500 00
5 tons of coal at $5.25	761 25
0 carboys of iron, 140 lbs. av. wt., at $2.75 per lb.	1,155 00
40 barrels of lime at $1.40	3,136 00
carboys of vitriol, 140 lbs. av. wt., at $2.75 per lb.	154 00
	$8,706 25

References: Rafter and Baker, " Sewage Disposal in pp. 369–382; New York State Board of Health, Rep
The illustration is a general view of the plant.

Since it is your intention that these plants be kept tinual observation, and that systematic analyses be ma vals of the raw sewage and effluent, it is hoped that t the different types of plants, compared in reference t variation in construction and in the variation in th of the sewage, may be pointed out as a guide to mu contemplating the construction of similar plants.

Respectfully submitted,

H. N. OGDE
Special Assistant

[TARY INSPECTION OF SUMMER RESORTS

ALBANY, N. Y., *November* 15, 1907

: H. PORTER, M.D., *State Commissioner of Health,*
)any, N. Y.:

SIR:—I beg to transmit the accompanying report of .. N. Ogden, Special Assistant Engineer, on an investiga- the sanitary conditions of summer resorts in the Catskill ns and on Long Island.

nvestigation of summer resorts was first taken up by the ıent in 1906, when in response to general notices a large of reports on blanks specially prepared were filed with)artment by the proprietors of hotels and other resorts in all sections of the State. The information thus ob- evealed insanitary conditions that emphasized at once a need of greater protection to health of the people of the ho yearly seek these resorts for rest and diversion.

work during 1907 was accordingly planned and carried a view of securing more definite and accurate information ə conditions surrounding these resorts; information upon efinite action could be taken by the Department, if neces- compelling any improvements that might be needed, or hich definite advice could be rendered to the owners or ors of these establishments, as to the nature and extent improvements. It was hoped, at the beginning of the that it would be possible to extend our investigation to ctions of the State, especially in the Adirondack region, as found that to do this work in a thorough manner re- nore time than was originally planned for, with the re- ; it was possible to cover only the Catskill and the Long egions.

These notices will be followed by a seco
during the coming spring for the purpose of
the requirements of the Department have be
respect to these notices, and at the same ti
gestions or aid that may assist the propriet
these improvements. These inspections will
liminary work of our summer resort investig
of 1908, which it is your intention to have e
Adirondack and other regions of the State.

Respectfully yours,

THEODORE

ALBANY, N. Y., *No*

MR. THEODORE HORTON, *Chief Engineer, S*
Health, Albany, N. Y.:

DEAR SIR:—I beg to submit herewith a
gation of the sanitary conditions of summer
kill mountains and on Long Island during th
1907:

The present day custom of taking a vacat
to recreation, is constantly increasing. The

The length of the coastline of Long Island is probably greater han can be found in any State on the Atlantic seaboard except Florida; every mile of this is suitable and available for summer outing resorts. Closely allied to the seashore resorts are those to be found on the shores of the lakes which bound or are scattered over the State: Ontario, Erie, Champlain, Cayuga, Seneca, Oneida, Chautauqua and a thousand smaller lakes, which, together with the Thousand Island region and the St. Lawrence iver, afford a wide range of scenes and a diversity of amusements. Among the mountain resorts, the Catskills and the Adirondack egions have long been favorite outing and recreation grounds o the people of the Eastern States. The beautiful pastoral regions to be found on both sides of the Hudson have also attracted many hither to enjoy a quiet rest in a rich farming region. Indeed, there is hardly a county in all the State that does not afford some scenic or natural attraction about which has grown up a summer resort for people from the cities.

The task of caring for the large numbers who seek such places is no light one. On account of the short season, from four to ten weeks, employment of labor to meet the requirements is attended by an exaction of high wages which requires the payment of high prices for all service. The high scale of prices for accommodations at all pleasure and health resorts is mainly justified on the grounds of large capital investment and short seasons together with the risks of disastrous effects of unfavorable weather. Hence there is a natural tendency to reduce the permanent investment by cheap construction and slighting of proper maintenance. In no line is there more probability of this than in the sanitary arrangements and conveniences since the cost of modern plumbing is high; the water rates are always excessive for temporary services and money invested in sewage disposal plants brings no dividends.

For many years it has been the opinion of the medical profession that many of the cases of typhoid fever which are so frequent late in the summer and in the early fall are contracted in the summer hotels and boarding-houses where improper sanitary conveniences and polluted water supplies afford ready means of spreading the infection.

It was with a view of learning the exact conditions at typi
summer hotels that the investigation was undertaken, and
the hope that the result of the investigation might be to imp
the sanitary conditions at certain places reported as unsati
tory, thereby protecting the people of the State from the dan
involved in even a brief residence in an insanitary resort.

In following out your plan for this inspection it became
dent that the single inspector available could not visit all
of the State in a single season and it was determined a peri
about one week should be devoted to each of the following
cipal regions: Long Island, the Catskills, Lake Champlain
St. Lawrence valley, the Adirondack region, Lakes Ontari
Erie, Central New York, Western New York. It was
that only a very superficial inspection could be made in s
brief period and the time given to the sections visited was
more than the week contemplated. The work of this past su
must, therefore, be regarded only as a beginning of a large

An idea of the magnitude of the work can be had fro
list of summer hotels and boarding-houses published by the
York Central & Hudson River railroad. These may be gr
as follows:

Hudson river region................................
Catskill mountain region............................
Lake George region.................................
Lake Champlain region.............................
Adirondack mountains ....
St. Lawrence valley................................
Central New York..................................
Western New York.................................

When it is considered that this list is made from an
tising circular of one railroad calling attention presumab
resorts only on its own lines, it will be seen that a very
estimate will place the total number at three times this nu

at least, or approximately 5,000 hotels and summer boarding-houses which should be visited and looked over, the plumbing examined and information obtained in regard to the water supply and sewerage.

The advertised capacities of these 1,720 hotels will aggregate nearly 50,000 and it will be well within the limits of belief if we say that the other unlisted hotels will make the number at least 150,000 as the total capacity of the summer hotels of New York State.

A large number of the summer resorts of the State are already under the careful supervision of local health officers in the cities and incorporated villages and they may be trusted to take proper care of their own districts. But there is a still larger number of these hotels and boarding-houses situated in remote parts and away from the surveillance of active sanitary officers and this is particularly true of the mountain camps, the farm boarding-houses and even of the large hotels in sparsely settled regions in the mountains and North Woods.

It may be also noted that the smaller towns cannot be expected to stand the expense of supervising the sanitary arrangements in these remote regions; the cost would be far in excess of their resources and it would, therefore, appear to be a proper field for State supervision since the work is mainly to protect the health of city people temporarily in these regions.

LONG ISLAND

The territory examined in this inspection extended from the Nassau-Suffolk county line easterly along the south shore of Great South bay to Patchogue, together with the sand spit known as Great South beach or popularly as Fire island. The distance is about twenty-five miles as measured on an east and west line, and the inspection was confined entirely to the region in the immediate vicinity of the shore, the summer hotels being rarely more than a half mile from the shore.

these companies is excellent in quality from bot
biological points of view.

The gathering grounds of the supply extend fr
ridge of the island to the shore. Much attention
by the geologists and hydrologists of the United
ical Survey to the water resources and methods of
in this island; the quantity has been calculated
supply millions of population and the quality ha
as irreproachable. This has been true in the pas
increase in population of Long Island and parti
velopment of building sites in the interior of
soon menace the quality of the water drawn fron
wells. At present the populous centers of L
confined to the immediate vicinity of the south sh
terior is a barren sandy waste affording sustenan
growth of pines and oaks and containing few h
The promoters of suburban real estate schemes
form large tracts of this great area into home sites
ible to the city by increased transit facilities and
truck gardens and farms by the aid of irrigation,
which may be had by pumping from a shallow

This increase in population which is taking pl be said of Long Island that its water supply is excellent and not to be suspected as much as the milk supply or shellfish as a source of infectious diseases.

Sewerage

Practically there are no public sewers east of Jamaica on Long Island, although sewerage is the one great need of the summer settlements and as the density of population increases the need becomes more urgent. They are badly needed now in the most populous centers but on account of the peculiarities of the population of these places their advent will be long delayed unless some lawful authority compels their construction. The winter and voting population of these towns and incorporated villages is small and a large part of the cottage and hotel property is owned by nonresidents who can have no voice or influence in the government of the place. In general, the city people would welcome the construction of a sewer system, knowing its value and convenience; but the older residents who have not reached that higher standard of living and who are less wealthy are opposed to the construction of sewers. They cannot see the money value of such an adjunct and while they retain the control of the local government there will be no sanitary sewer system.

At the present time, the usual practice is to make use of cesspools. The subsoil is entirely favorable for this method of disposal as the uniform size of the sand grains makes a very porous filter, allowing a free movement of the liquid in escaping. In the more recently constructed hotels, the cesspools are built in series and grease traps are provided to recover the grease from the kitchen and laundry drainage before reaching the cesspool. A set of cesspools consists of a water-tight vault built of brick laid up in cement mortar, and intended to act as a septic tank, and overflowing by siphons into one or more vaults with porous sides and bottom with sufficient percolating area to give a rapid exit to the liquified effluent from the septic tank. These cesspools are cleaned each autumn at the close of the season. In the absence of a public sewer and sewage disposal plant, the use of this type of cesspool is entirely commendable in those places

less serious matter than it would be in any ot
country with a permanent population. The on
can be urged is that it may be a pollution to t
supplies and this generally does not hold on the s
the ground flow is all toward the sea and where
inland.

When the hotels are situated so near to the shor
water level approaches the surface, resort m
another method of disposal; in this case the be
be to receive all sewage in a water-tight vaul
pumped out and the contents removed at short i
larly licensed and properly equipped nightsoil n
of these vaults are to be found in the hotels on
and every village has one or more firms doing a
of cleaning such vaults by annual contracts; th
carried away in large tank wagons and deposit
ground beyond the populous centers. The places
ter is habitually deposited should be restricted so
shall not affect the water supplies or cause unp
the vicinity of popular drives. The practice o
solid matter from these vaults and mixing it wi
to be used to fertilize gardens, should be forbid
too great danger of spreading disease among thos
sume vegetables raised thereon. A few instanc

slight tide in the day is not sufficient to cause any flushing effect in these basins and the ground water flow has caused a change from salt to brackish or semi-sweet water permitting a luxurious growth of algæ. The decomposition of this growth under the influence of slight inroads of salt water in storm periods together with the heating effect of the sun on such shallow flows causes a putrefaction, giving forth a noxious gas which is plainly a nuisance even though it may not be a sanitary danger. The nature of these gases is plainly sulphureted hydrogen since the characteristic reaction on a newly painted boat is plainly shown; the white lead turning black within twenty-four hours.

The Dunes

The peculiar conditions existing on the sand spit known as Fire island or Great South beach deserve special attention. This region is one of sand dunes thrown up by the Atlantic storms and further modified by the eroding and carrying power of the strong sea breezes and wind storms acting on the dry sands. The dunes reach an average elevation of twenty-five feet above mean sea level and while generally forming a continuous ridge parallel to and about 100 feet from the mean tide shore line, they often take on curious shapes and modifications of form and position due to the wind action, forming internal valleys and basins and ramifying spurs. The width of the dunes may vary from 100 to 300 feet and their transverse profile will generally show an abrupt slope on the ocean side and a very gradual slope on the land side, falling to the level of the salt meadow. Where covered with a good growth of dune grass, their position and profile may be regarded as fixed, but when this growth is destroyed for any reason, as by excavations, a movement of the sands may occur which will affect a large area before it ceases.

On this elevated ridge of fine sand several colonies of summer cottagers and a few hotels have been built, the tourists being drawn thither by the superior surf bathing facilities and attractive outlook on the ocean and by the unfailing sea breeze. Being separated from the main island by Great South bay, a shallow stretch of water averaging four miles in width, the water ply is due to the rainfall on the dune area and condition is due to the filtering effect of the clea which holds it. The difference in the specifi its separate and unmixed existence in such clo the salt water. It lies at about sea level and in depth and rises and falls with the tide. W this level will yield a brackish water or even bri depths. Doubtless there is a slight lateral mov shores due to the additional supplies received f and to draughts upon it from the pump-wells of the season or if the season is dry, the sweet v exhausted in narrow localities. The developm plies is not attended with great difficulties or e well may be driven in the sand at any point in requires no equipment other than a drive pipe o to reach to or slightly below the level of mean with a strainer on the end. This pipe can be the loose sand by a wooden maul and by attac abundant and cheap supply of good water may b

Where the cottages are not too closely spaced is given to the disposal of sink water, slops, ga closet contents, the water supply of these sur need be no cause of infection. The twenty fe ventilated sands which may overlie the water be quick and certain. When the water supply is drawn from the ground in close proximity to privies, urinals, kitchen drains and garbage dumps, and particularly when the filtering material becomes reduced to a few feet of coarse sand, then pollution of the water supply becomes certain and inevitable.

A large area of low flat meadows is found to bound the dunes on the north side and in this area and between the bay and the dunes sites for cottages have been chosen because of the shelter afforded from the strong sea winds. The land stands at but a few feet above the mean tide level and the closet vaults and cesspools are sunk into the ground water; wells in this area are polluted beyond question. A few such exist.

Fortunately the land is cheap and the cottages are not crowded generally, each cottage having its own pump. The dryness and porosity of the soil allows such ventilation of the soil that a complete nitrification of organic matter is effected before it can reach the ground water level. The contents of privies when not received by boxes and removed will decompose between seasons if allowed to remain on the ground in masses not too great to be desiccated. The more progressive settlements have provided for the removal at frequent intervals of all decomposable matter from pail closets, garbage cans and cesspools; and the water supply is drawn from remote parts of the dunes away from habitations, distributed by pipes to each cottage or building. A most commendable example of such sanitary precautions is to be found at Point O'Woods where all such duties are discharged under competent supervision by regular employees of the association which controls this settlement.

At the present time the settlements on the Great South beach sand spit are comparatively few in number, but the total number of summer inhabitants must reach several thousand. The chief settlements are Fire island, Oak Island beach, Cherry grove, and Point O'Woods; the latter three being visited. Muncie's island is separated from Fire island by a channel, this island containing a large sanitarium which is supplied by a very deep well drawing from the ground flow of the main island.

have made their romances and traditio
tions of the youth of America; for mor
have been visited by American tourists
and a change of air. Hence we might
gion a high development in the art of
a health resort we would be justified in
sanitary measures. It cannot be sai
have been realized, and the region in
pointment in its general and public san

The Catskill region may be roughly
cipal zones corresponding closely wit
Esopus, Schoharie and Delaware drai
regions are not definite and the count
of the Catskills on all sides is also a sum

Considering only that more mountai
Greene, Ulster and Delaware counties
difference in numbers between the su
tions is extreme. There are very few
the areas of the township are very gre
of the region and particularly that pa
drainage, the proportion of waste mou
Ulster county, and agriculture, the mi
ing of summer boarders afford occupat
population than is to be found in the
away from the necessary railroad facili

part of the total summer population are from the east side down town districts and of the Jewish merchant class; the kills having changed from an exclusive to a popular resort. importance of the Catskills as an influence on the general lic health in consequence of the increased numbers of people frequent this region in search of recreation and health thus omes greater each year as the number increases and this con-on of affairs calls for improved sanitary conditions at the ls, boarding-houses and all other resorts.

The increased number of tourists has led to the building of re hotels and the construction of additions, extensions and nexes to the older establishments; but the majority of the ldings were built fifteen years or more ago and their san-ry fixtures and plumbing arrangements are of a type no longer be considered suitable for use in public places.

The practice of venting all traps and of using separate pipes r ventilation and for sewerage is almost unknown; only in a ry few of the newest hotels is a trap and ventilator to be und on the outfall pipe to the cesspool.

The newer hotels show a superior type of fixture and plumb-ng and it is very probable that the process of additions and renovation which is taking place gradually as the capacities of the older places are modified to meet the new conditions of trade, that all the obsolete fixtures will be replaced by modern types of san-itary fixtures.

Sewerage

While the plumbing leaves much to be desired, the methods of disposal of sewage are most unsatisfactory and deserve immediate attention. The geological structure of the Catskill region is mostly sandstone and shales in nearly horizontal strata with a very sparse soil; most of the streams run on bed rock and the mountain sides show frequent outcrops of bare rock in large areas. When covered with earth, the material is a hardpan clay and very shallow in depth; porous gravels are almost unknown. The soil is impervious and not adapted to the use of cesspools for sewage disposal.

Yet the use of cesspools is universal, and as wou
pected naturally, in such soil they are seldom satisfa
generally a nuisance and a menace to the water suppl
region. They must be made of great size and in m
an overflow is provided to the nearest watercourse. Th
along the surface and through the seams of the bedroc
ably as great as through the compact mixed soils in w
are built. The polluted condition of the streams is to
regretted and shows a shortsighted policy on the part
munities in which it is permitted. These mounta
should be attractive features in their localities and sho
served in their primitive purity. In several of the
villages this practice has been tolerated by the local
Griffin's Corners, and Pine Hill are the worst cases
by sewage and disfigurement by dumping, but the sa
exists to a large extent at Hunter, Tannersville an

A most commendable instance of the care of na
courses is the case of Stamford where a strong publi
has wrought a great deal of good in the general nea
town and its watercourses.

A public sewer system already exists at Stamford a
sewerage system is to be found at Haines Falls; th
the Catskill Mountain House, the Kaaterskill, Suns
Grand Hotel is in each case conveyed a considerable d
the hotel and then discharged over a cliff onto a ta
debris which acts as a trickling filter. The sewage
is treated by chemical precipitation and the effluent
into the Delaware. A system of public sewers an
plant is a necessity which should be immediately sup
cases of Fleischman's, Griffin's Corners, Pine Hill
Hunter and Tannersville.

Water Supplies

Incorporated water companies, selling water from
supplies or from large developed springs exist a
Griffin's Corners, Phœnicia and Hunter. The supp
eral hotels in the vicinity of High Mount and Pi
taken from the private water works of Dr. Butler.

gest hotels have elaborately developed water supplies for their n use only. The majority of hotels have spring supplies ich are preferred for drinking and cooking even when con-stion is had with the water companies' supplies, the latter ing used only for toilet or laundry. Whenever possible, these dividual springs were visited although they were often located points remote and difficult of access; sometimes they could t be found without the aid of a guide. A general fault to be und with these springs is that not sufficient protection is given o the pools and basins to prevent contamination by surface wash n wet weather. They were generally located at a distance and at a considerable height in the forested zone of the mountain side and away from apparent danger of contamination; but the surface wash on those steep and impervious slopes might cause infection from dejecta placed on the ground by mountain climbers. Some of the supplies which were originally developed away from habitations are now in danger of pollution from cesspools placed at a higher elevation by new hotels or cottages. These springs are usually shallow wells and the opportunities for infection and contamination are very great in a region with such shallow soil covering. In all probability the greater part of the springs are from the sandstone and shale strata; the passage of water through faults and seams of rock is not attended by any purifying action as in sand or earth; hence all such springs are to be regarded as suspicious.

As a practical illustration of the results of the month's work, it may be added that, besides the general characteristics of the two districts, as stated above, a matter which must precede any intelligent action on the reports made, sixty-four separate hotels and boarding-houses in the Catskills and on Long Island were carefully investigated. The water supply, plumbing and method of sewage disposal were thoroughly examined, and a specific statement made of these conditions existing in regard to each of these matters.

These sixty-four reports or statements were carefully studied and forty of them laid aside, the conditions, apparently, being above reproach, and not requiring further action. Twenty-four of them showed undesirable conditions; some had water supply

These cases have all been taken
spondence carried on with each propri
case promises have been received by
particular offense should be remedie
In some cases the proprietors have re
apparent irritation, and have been un
any criticism could be justly made, wl
gestions have been received courteous

In conclusion I beg to recommend
tion which it is your intention to hav
spring of the twenty-four hotels which
present conditions, if the remedies adv
been adopted, the Department will ta
the hotels, or at least will sound such
public will be very slow to patronize t

Respectfu

Sp

TIGATION OF THE CONDITIONS OF ICE VESTING ON THE MOHAWK AND HUDSON ERS

ALBANY, N. Y., *December* 27, 1907.

E H. PORTER, M.D., *State Commissioner of Health,*
lbany, N. Y.:

R SIR: — I beg to transmit herewith the accompanying re-
Mr. Henry W. Taylor, Assistant Engineer, on an inves-
n of the ice supplies harvested from the Hudson and
k rivers, included between Waterford on the Hudson and
ctady on the Mohawk, and the city of Kingston on the
n.

report explains fully the objects and scope of the investi-
The statistics presented, though physical in their nature,
1 valuable information as to the sanitary conditions under
this industry is carried on in this locality, and as to the
lity and probability of any real danger to public health of
lepending upon these sources for their ice supply.

eneral, the plan, table and description include the methods
ed in the harvesting and storage of ice; the general loca-
each of the icehouses and ice field; their relative location
espect to sewer outlets and sewage pollution; and of the in-
s of certain factors in intensifying or diminishing the
of the pollution of these supplies. The report concludes
ecommendations as to the continuance of the investigation
e supplies, especially during the harvesting period, and of
ing the work, already advanced, of collecting samples and
the quality of the ice from certain icehouses and ice fields
view of determining the effect of any pollution during
ting and following the storage of ice.

ough at this time confirmatory data of a chemical and
cal nature is not available, nor even possible, owing to

many cases of probable contamination and
flagrant that such evidence would not alte
sible contamination and danger.

In view, then, of the information presc
the conclusions therein stated as to the pc
of districts or sections along the river, I h
your directions prepared a list of speci
which, in my opinion, are located, with r
lets, as to render the ice cut therefrom su
and, therefore, a menace to health. It i
cutting of ice from these fields should l
seems to be no adequate reason for taking
matter, especially upon the grounds of sou
notwithstanding the ameliorating effects of
the death of germ life, for this is not cor
move the inherent objection to drinking w
sewage and organic filth, even though st
standing the cost to the owners of movir
operation to other locations, which would b
such pollution and contamination.

This list is appended below. It should
tains only the houses the location of whic
no doubt as to prohibition of ice cutting.
fore, be considered preliminary and subje
the information of a chemical and bacteri

7, when the general subject of ice pollution and purifica-
thoroughly reviewed. At that time you clearly pointed
al and imaginary dangers to public health involved in the
g, storage and distribution of ice from waters subject to
conditions and pollution, and that, in your opinion, the
f ice from fields in close proximity to sewer outlets is
with real dangers, and is offensive to the sense of
use or even ordinary decency.

emedy for these conditions there was prepared and pre-
the Legislature of 1907 an ice bill so framed as to give
ate Department of Health certain powers to regulate the
harvesting and storage of the ice supplies of the State,
with it the necessary provision for enforcement of these
ns, and for the necessary inspections and supervision of
upplies. This bill was not passed by the Legislature,
n view of the lack of any specific authority over the con-
he ice industry vested in the Public Health Law, the
ow stands in the same light that it did a year ago.

thstanding this lack of specific authority and control over
ic ice supplies of the State, it is clearly the duty of the
ent, in so far as it is possible with the limited force and
ailable for work of inspection and investigation, to dis-
ces and conditions from which ice is cut and delivered
blic to the possible detriment of health, and to call the
of the proper officials or parties to the facts and notify
liscontinue the cutting and sale of such impure ice. And
nd I would recommend that notices be sent to the owners
ses, included in the list above given, calling their at-
o the dangerous location of their houses and ice fields
pect to sewage contamination, emphasizing to them the
of removing their houses and operations to fields which
tically free from such dangers, and that, unless these re-
ts are not carried out in the future, it is the intention
epartment to give full publicity to the facts, and to notify
lly the districts where such impure ice may be sold or
d.

Respectfully yours,

THEODORE HORTON,

Chief Engineer

to Cohoes.

The investigation was started on Decem
of Albany and Troy. The work was then
west side of the river, with stops at R
Baltimore, Coxsackie, Athens and Cat
crossed at Catskill and the inspection con
with stops at Hudson, Stuyvesant and
Schenectady, Crescent, Cohoes and Waterf
on the lower Mohawk and a special inspec
South of Catskill the field inspection w
creek and the vicinity of Kingston, to whi
In all about eleven days were spent in the

Nature and Scope of Inve

In this investigation, as outlined by y
gain, by definite knowledge (1) the loc
of the sources of pollution; (2) the met
comprehensive view of the dangers of c
the ice is exposed, and the location and p
dangers. Accordingly the following inf

1. The names of operating firms and
houses.

The above data was in each case filed on a blank form and cations were made in the field on United States Topographical ieets. Information regarding the icehouses and fields, and ie methods of harvesting, was obtained from superintendents or wners of houses. The sewage data was secured from city en-ineers, commissioners of public works or health officers. When ossible, the location of outfall sewers was taken directly from cal maps. In case of the factories whose wastes are mentioned i detail a personal inspection was made of the plant.

Eighty-five per cent. of the houses and fields listed were in-ected in the field as to location and surroundings, the remainder ing not easily accessible. As often as it was practicable, the uses were also inspected as to their planers and harvesting ma-inery.

Throughout the investigation great care was taken to choose ie most reliable sources of information, and personal inspection ras carried as far as possible; and though estimates rather than ninutely exact data often had to be accepted, these estimates, we believe, are sufficiently accurate for the purposes of this investigation.

Maps and Table

The accompanying maps and table give in brief the results of the investigation. The maps show the location of icehouses as solid blue circles with numbers corresponding to the map numbers in the table. The sewer outfalls are indicated by short red lines on the shore of the river. The table is a brief compilation of the data obtained, and explains itself. It must be remembered in connection with that part of the table referring to proximity of sewers that detail has been necessarily sacrificed to brevity, and the figures and estimates are approximate and suggestive rather than conclusive and final. In general, sewer outfalls located on both sides of the river have been regarded as affecting ice fields, allowing for the probable influence of tides in disturbing the natural side channel flow of the sewage. In general, it may be assumed that the center of the channel is the location of the ice fields, though there are exceptions to this general statement.

General Statements

With the aid of these maps and the table we ı following general statements:

Capacity and operation of houses.— The total nun listed is 131 and there is represented a possible ca proximately 3,294,000 tons of ice, of which amoı per cent. was harvested in 1907. According to the obtained, about 32 per cent. of the total number o about 40 per cent. of the total capacity) is contr American Ice Company. There are thirteen firm more than one house each. However, only one of t firms operates more than two houses, excepting the Company, and there are in all seventy-seven indep operating the 131 houses.

Disposal of ice.— The table shows that only 17 the houses may be classed as retail houses, which re 8 per cent. of the total capacity. The remaining are operated by shippers who deliver the ice in la to Yonkers, New York, Newark and Jersey City.

Storage.— Probably every season there is a certa ice left over and stored until the second summer. harvested during the winter of 1906–07 there is es about 28 per cent. still stored in the icehouses. of the summer of 1907 was exceptional, howeve roughly estimated that the mean percentage of ordinarily is about 10 per cent. of the total amoı The storage of the new ice is, therefore, increased of time required to consume the old, and indirectly this year's the reserve supply tends to confine the i choice of the better ice fields, making it practicabl poor one.

Location of icehouses.— The maps show that cent. of the houses are located on islands or " pl islands are, with two or three exceptions, low lyi and narrow in outline, affording no slopes or wide face wash. In general they are not inhabited or c contain merely the icehouses, shops and sometimes ice company. The distribution of the remainder

ıately as follows: 12 per cent. on the Mohawk and
; 8 per cent. on Catskill and Rondout creeks, while
:. are on the west side of the Hudson river and 11
the east side.

e of the river on the west side, below house No. 54,
. more or less abrupt cliff. The houses here are built
tending out into the river. The majority of the re-
the houses are located on the flood planes of the river
ases of long steep slopes behind them. In general,
showed that there is little probable danger of con-
urface wash reaching the ice fields.

of ice fields.— The ice fields are, as a rule, within a
icehouses. The exact location of field chosen for a
'ear varies considerably. The best ice is sought, and
is willing to go a mile or over to get it. In the large
cases the ice, it was said, is cut from the channel,
the shore, though there are instances of cutting from
ls. No estimate of less than four feet was obtained
um depth from which ice is cut. The average esti-
bout eight feet.

of sewers.— In regard to the pollution of the ice
ınce at the tables shows that the extreme conditions
e vicinity of Albany, Troy and Schenectady.

ıuse No. 37 there is the sewage of less than 30,000
'ing the river in over forty or fifty miles. The danger
ır district, then, is relatively more local than general.

The Hudson River

ortant features of the flow of the Hudson river ma-
ct the problem of ice pollution. It is estimated from
.e gaugings of the Upper Hudson and Mohawk that
ow of the river for the three months of December,
d February, taken together, is but little less than the
for the year. The mean flow for this quarter of
ferred to above is about 10,000 second-feet. The
ıbout 210,000 people (which we think is a fair esti-
ı population served by sewers in Cohoes, Waterford,
gh, Troy, Watervliet, Green Island, Albany and Rens-

of contamination. They complicate the
of sewers to ice fields, in that a reversal
plicates ice fields above as well as below a

No special investigation of the locatio
versal of flow was made owing to lack of ti
information obtainable is that:

1. Above the State dam at Troy there

2. Below the dam in the vicinity of
probably is no reversal of flow in the w

3. At Poughkeepsie the city engineer
of flow amounts to about three miles.

Discussion of Different I

Similar conditions of topography, sew
flow and tides naturally divide the whol
separate districts, and for convenience th
in detail under the following divisions:

District No. 1 (*Mohawk River*)— *Schene*
and Waterford

In this district there are ten houses l
clusive. The two houses in Schenectad
[illegible]

short one or two block sewers. Above these sewers there arged the wastes from the General Electric factories, as 1 an inspection has already been made by this Department. ice men in Schenectady are forced to meet the require- f a local 250-feet limit law, which stipulates that no ice within 250 feet of the Schenectady shore. House No. 1 elevator planers, but it was stated that the owner uses aners.

flow of the Mohawk is sluggish in Schenectady but gains current at Dunsbach Ferry and Crescent. Houses Nos. 0 are located just above the first dam above Cohoes, where rent is again dissipated. These houses have no elevator but plane in the field. House No. 6 has neither elevator d planers.

No. 2 (Hudson and Mohawk)— Waterford, Cohoes, ansingburgh, Watervliet, Troy and Port Schuyler

is group we shall consider houses Nos. 11 to 23 inclusive. re a relatively large number of retail houses in this dis- Nos. 11 and 12 peddle in Waterford; No. 13 in Cohoes; and 17 in Troy; Nos. 20, 21 and 22 in Watervliet; and in Port Schuyler. One house does not plane the ice at four have no elevator planers.

district, being thickly populated on both sides of the has many sewer outlets discharging within it and in the k above it. There is first the pollution of the Upper , which has been detailed in an exhaustive report of this nent. The Mohawk from Cohoes brings in the sewage of people, and of 4,000 people from Waterford in its three . It is estimated that of the sewage of Cohoes 75 per kes the route of the southerly sprout, which thus may be ed to carry the sewage of 17,000 people; the two upper carry 25 per cent. of the sewage of Cohoes and all the of Waterford, or in all the sewage of about 10,000 people. well be stated here that the water consumption of Cohoes large, varying from 350 to 400 gallons per day, due to the umber of knitting mills which use large quantities of n washing and dyeing.

about [illegible],000 people. Watervliet, from 2
charges the sewage of about 8,000 people,
sewage of about 3,000 people. Within th
is the sewage of about 90,000 people disch
Hudson, and that of 27,000 coming from t

There are six houses located on the St
supply of this basin required a special in
out the following facts:

The State basin is a body of water lyin
and south of the dike running from Gr
Through this dike there is an old culvert
nection with the southern sprout of the
culvert is equipped with a small sluice gat
of the basin is another dike connecting
Island, and there is a culvert here, dam
about three feet. At the south end there
Hudson river with a drop of about eight
nection with a stub from the Erie canal,
Hudson with practically the same eight-f

The main source of supply of the Stat
from the Champlain canal, which is kept
with the exception of a couple of weeks i
ing. A creek carrying surface and sprin
to the west flows under the canal at the o
a small percentage of the supply. The

Unless the basin were to drop about one and one-half feet, river were to rise that amount, the Mohawk water could irectly enter the basin. There are no sewage outlets that rge into the basin, the 24th street sewer of Watervliet being nder it to Green Island and the Hudson river.

regard to tides in this district, the consensus of opinion is though there is a rise and fall in the river, there is not in inter season a reversal of current except in very rare cases.

summary of this district:

Houses Nos. 16 and 18 to 22, inclusive, are on the State which requires further examination for final judgment.

Houses Nos. 12 to 14, inclusive, are below the sewer dis- of Waterford and about one-fourth of that of Cohoes (rep- ing in all about 10,000 people).

House No. 15 is just below the sewage discharge of Lansing- , and No. 17 is more remotely so.

House No. 23 is two blocks from the 9th avenue sewer of Schuyler.

istrict No. 3 (Hudson River)—Albany, Rensselaer and Vicinity

is group includes houses Nos. 24 to 37, inclusive. The r section includes Albany, Rensselaer and five retail houses. lower section marks the beginning of the large wholesale s, with, according to the information obtained, the complete ng machinery for elevator and field planing.

any, it is estimated, discharges into the river the sewage of 80,000 people. The Patroon creek sewer, the most north- out one, serves upper Broadway and vicinity, and receives ondensation wastes of the Municipal Gas Company. These s do not represent a large flow, but are very concentrated how a considerable amount of oily and yellowish matter at wer outlet. House No. 26 cuts its ice above this sewer but ld is affected by drainage from the yards of the gas com- which finds its way into an old State drain at Bridge street. e sewers discharging from the many streets footing on the represent smaller districts, with the exception of the Arch

At Bassett street, about 500 feet south o
House No. 29, which cuts its ice in the
the house. This Arch street sewer discha
serves about 20,000 people.

The sewage of Rensselaer, estimated a
people, is discharged at Second avenue, t
5,000 people, and through two outlets
street to the north. There are also other
overflows.

In South Rensselaer the American Anal
inside the dike just above House No. 32
per day of coil condenser water, and wate
products, the latter containing per day ab
100 pounds of common salt, and 300 po
The lime neutralizes the acid and causes
within which these wastes are discharged
forming a basin, which, I was informed,
tides. In case of a freshet these wastes
carried into the river.

Houses Nos. 30, 31 and 32 are just
of Albany and Rensselaer, and Houses No
in the midst of them, House No. 28, how
side of the river.

r wholesale, are large, and, as far as could be ascertained, well equipped with planing machinery for both field and tor planing.

e sewage entering the river within this district consists, first, at of Castleton, where there are only two sewer outlets repre- ng about a hundred connections, of which twenty convey t wastes, the remainder being for kitchen wastes and cellar age. At Coeymans, a brook partially covered discharges the river a little below House No. 60 the sewage of about people of Ravena and Coeymans.

is probable that this far down the river there is an appreciable sal of river current due to the tides, though its extent is a ion of a mile. The river is broad with many low-lying ds and flats and side channels. In general, the information ined would justify the statement that the ice is cut chiefly the main and deep channel. There was obtained only one nate of less than five feet for a depth of water from which is cut.

District No. 5 *(Hudson River)— Stuyvesant, Coxsackie, Athens and Hudson*

The houses included in this group (Nos. 78 to 106 inclusive) practically all wholesale houses. The river grows broader and shallow on the east side, having many flats, the channel being ard the west shore.

Coxsackie has a crude system of sewers, consisting of old nat- l channels, which have been partially covered and enter the dson a little above Houses Nos. 89 and 90, carrying the sew- of about 1,000 people. Athens has only two sewers, having all about thirty house connections, discharging into the river ; above House No. 104. The city of Hudson has two main k sewers, the south trunk serving about 3,000 people and northern sewer, discharging into North bay, serving about 0 people. This sewage reaches the river through a culvert the New York Central & Hudson River railroad fill. The houses in Hudson are both retail. One is located about 0 feet above the southern sewer and the other in North bay

and Vicinity

The vicinity of Catskill includes Hous
clusive. The reversal of tide in this di
tion of ice fields as well as the conditions i
the meager data obtainable, an estimate o
river to the extent of one mile would see

The Department has already reported
Catskill creek, and has stated that its cond
as a nuisance. The fact still remains fro
view that the sewage of about 3,000 peopl
and the action of the tides tends to dam
creek and create deposit and retention of t

There are four houses directly on the c
peddles in Catskill, the other houses being
however, that the main domestic supply o
two houses located above the dam in the c
free from any influence of Catskill sewa
the river in this district stand in a posi
of Hudson serving about 9,000 people.

District 7 (Hudson River and Rondout
Vicinity

here are six houses on the Rondout creek, two of which do have elevator planers. No. 128 is a retail house.

he sewage system of Kingston serves about 25,000 people. sewage of only about 7,000 people is discharged into the r untreated, the remainder being collected and carried to a ic tank and contact beds. The capacity of this tank and beds however, not adequate to produce a nonputrescible effluent. sewage thus treated enters Rondout creek through the am indicated on the map.

Harvesting of Ice

n the foregoing discussion reference has been made to houses have no elevator or field planers. The importance of these ers and the other data collected with reference to methods of vesting will be stated in the description of a general case ch will include the information obtained.

he fact that the ice field is not laid out in the same place n year to year has already been referred to. It is, of course, the advantage of the ice man to select the field that will yield clearest ice and require the least treatment. "If necessary" field is planed off with field planers drawn by horses. This ning is done if the ice has a poor surface, or if the field has n tapped, allowing the water from beneath to flood the ice. is flooding or "tapping" is practiced by all the ice men. Its pose is to melt the snow that may fall on a thin layer of ice, ming a blanket that retards or prevents its "making" under- th. This snow cannot be scraped off when the ice is thin, and s melted by the water, forming a layer of snow ice. As soon the thickness then allows, these field planers are used to scrape the thin top layer, as this also is more or less porous and still ders the making of ice, and the ice man also wants to get rid this layer, as it is very apt to split off in harvesting or distri- tion, eventually becoming waste. It is claimed that all but ut an inch of this layer is "cultivated off" in the field, the t inch being left for the elevator planer.

he dangers of this flooding arise from two sources. The second er of ice may incase dust and dirt that has accumulated on the ginal ice, and in the freezing of the new upper layer of ice, sired thickness. The planers are generally a sharp edged teeth that leave a corrugated surfa uses this elevator planer for two reasons: it giv uniform thickness and an evenly lying floor ir leaves a corrugated surface, thus reducing the a tween a cake and the one above it, and lessen breakage in getting the cakes out of the house.

In most of the larger houses the cake in comi for shipment passes under a “ deadener ” which board full of spikes intended to catch the cake the elevator and hold it until the loaders in the b it. This constitutes a third scraping of the ic to reduce the thickness of the cake by about an i

Conclusions

In view of the foregoing statements, I, there clude:

As to Location of Icehouses and Fie

1. That in the vicinity of Schenectady, Troy are zones of dangerous pollution.

2. That well below these larger centers of pop the adverse testimony of future chemical and bi we may allow at this season of the year, at least, fication of the river, and that the dangers to

As to Harvesting

5. That in general ice is cut from a depth of water not less than five feet, and in the majority of cases from the main channel of the river.

6. That flooding is a universal practice.

7. That probably the flooding water ice is scraped off by the planers and that it is, to some extent at least, to the iceman's interest to so treat it.

And I further beg to recommend:

1. That this physical examination of the dangers to which the ice fields are exposed be supplemented by chemical and biological analyses as a verification of the above conclusions and as a future study of some more or less indeterminate problems involved.

2. That these analyses include the examination of water, of new and stored ice, at such icehouses and fields as are representative of the different conditions of pollution, existing in the several localities.

3. That for these analyses, samples be taken from the houses and fields included in an accompanying table appended hereto.

Respectfully submitted,

HENRY W. TAYLOR,
Assistant Engineer

TABLE ,

Giving Location and Capacities of Icehouses and Approximate Statistics Regarding Pollution of Ice Fields

Map No.	OPERATING FIRM.	Location.	Capacity, tons.	Whole-sale (W.) or Retail (R.).	HOUSES HAVING PLANERS.		PROXIMITY OF HOUSES TO SEWER OUTFALLS AND POPULATION SERVED BY SYSTEM.					
							WITHIN ¼ MILE.		WITHIN ½ MILE.		WITHIN 1 MILE.	
					Elevator.	Field.	Number of sewers.	People served.	Number of sewers.	People served.	Number of sewers.	People served.
1	N. D. Proper & Sons	Schenectady	8,000	R.	–	•	3	800	4	1,000	5	15,000
2	D. Wheeler & Co	Schenectady	20,000	R.	•	•	1	300	5	1,200	7	15,300
3	McLane	Rexford Flats	1,000	R.	–	–	......	......	......	......	......	......
4	J. K. P. Pine	Dunsbach Ferry	12,000	W.	•	•	......	......	......	......	......	......
5	A. Reloux	Dunsbach Ferry	10,000	W.	•	•	......	......	......	......	......	......
6	O. Maynard	Dunsbach Ferry	10,000	W.	–	–	......	......	......	......	......	......
7	C. N. Canton	Crescent	28,000	W.	•	•	......	......	......	......	......	......
8	Shaughnessy & Sons Ice Co	Crescent	30,000	W.	•	•	......	......	......	......	......	......
9	Emmett F. Slade	Crescent	10,000	R.	–	–	......	......	......	......	......	......
10	Emmett F. Slade	Crescent	2,700	R.	–	–	......	......	......	......	......	......
11	Salisbury Ice Co.	Waterford	4,000	R.	–	–	......	......	......	......	......	......
12	Meeker	Van Schaick Island	5,000	R.	–	•	......	......	5	3,500	8	5,000
13	Hudson River Ice Co	Van Schaick Island	2,000	R.	–	•	2	1,800	4	3,600	10	8,000
14	W. H. Wertime	Van Schaick Island	10,000	R. & W.	–	•	2	1,800	4	3,600	6	5,500
15	Shaughnessy Ice Co	Troy	30,000	R. & W.	•	•	1	900	3	2,700	6	5,500
16	Dotter Estate Ice Co	Cohoes	10,000	W.	•	•	......	......	......	......	......	......
17	B. Cooper Ice & Coal Co	Troy	45,000	R. & W.	•	•	......	......	1	6,600	3	2,700
18	Norton & Co	Watervliet	25,000	W.	•	•	......	......	......	......	......	......
19	McDonald Estate Ice Co	Watervliet	12,000	W.	•	•	......	......	......	......	......	......
20	D. McCarthy & Sons	Watervliet	4,500	R.	–	•	......	......	......	......	......	......
21	Oathout & Tafte	Watervliet	3,500	R.	–	•	......	......	......	......	......	......
22	John McBain	Watervliet	4,500	W.	•	•	......	......	......	......	......	......
23	P. O'Brien	Port Schuyler	7,000	R.	–	•	......	......	......	......	......	......
24	Solomon Ice Co	North Albany	....	W.			1	1,000	3	6,000	8	19,000
25	American Ice Co	Patroon Island	9,000	W.	•	•	In process of construction					
26	Hudson Valley Ice Co	Albany	10,000	R.			......	......	......	......	......	......
27	American Ice Co	Patroon Island	12,000	W.	......	......	......	......	......	......	......	......
28	W. A. Bonacker Bros	Rensselaer	20,000	W. & R.	•	•	......	......	......	......	......	......
29	R. B. Rock	Albany	25,000	W. & R.	•	•	2	6,000	9	25,000	12	35,000
30	J. G. Pappalau	Albany (Van Rensselaer Island)	7,800	R.	......	......	5	37,000	7	43,000	16	64,000
31	C. F. Schifferdecker	Van Rensselaer Island	20,000	R.	•	•	2	6,000	9	49,000	15	67,000
32	American Ice Co	Greenbush	30,000	W.	•	•	....	. .	4	29,000	11	49,000
33	American Ice Co	Bogart Island	20,000	W.	•	•	. .		4	29,000	11	49,000
34	American Ice Co	Cabbage Island	18,000	W.	•	•	. .	. .	. .	. .		
35	American Ice Co	Papscanee Island	11,200	W.	•	•	. .	. .	. .	. .		.

36	**Wheeler & Son**	**Wemple**	14,000	W.	*	*	......	......	......	......	......	......
37	**Wm. M. Montgomery Ice Co**	**Papscanee Island**	62,000	W.	*	*	......	......	......	......	......	......
38	**American Ice Co**	**Wemple**	56,000	W.	*	*	......	......	......	......	......	......
39	**Herrick & Staat**	**Papscanee Island**	24,000	W.	*	*	......	......	......	......	......	......
40	**American Ice Co**	**Bear Island**	58,000	W.	*	*	......	......	......	......	......	......
41	**G. N. Best**	**Cedar Hill**	38,000	W.	*	*	......	......	......	......	......	......
42	**G. N. Best**	**Campbell Island**	35,000	W.	*	*	......	......	......	......	......	......
43	**W. S. Scott**	**Cow Island**	40,000	W.	*	*	......	......	......	......	......	......
44	**C. N. Baker**	**Selkirk**	31,000	W.	*	*	......	......	......	......	......	......
45	**American Ice Co**	**Schermerhorn Island**	58,000	W.	*	*	......	......	......	......	......	......
46	**C. N. Baker**	**Selkirk**	14,000	W.	*	*	......	......	......	......	......	......
47	American Ice Co	Castleton	14,000	W.	*	*	1	200	2	400	......	......
48	Yonkers Ice Co	Schermerhorn Island	54,000	W.	*	*	1	200	2	400	......	......
49	August Grill	Shad Island	37,000	W.	*	*	......	......	......	......	......	......
50	American Ice Co	Upper Schodack	26,000	W.	*	*	......	......	......	......	......	......
51	August Grill	Shad Island	25,000	W.	*	*	......	......	......	......	......	......
52	Patterson & Elder	Coeymans	35,000	W.	*	*	......	......	......	......	......	......
53	W. O. Parkinson	Coeymans	18,000	W.	*	*	......	......	......	......	......	......
54	American Ice Co	Coeymans	32,000	W.	*	*	......	......	......	......	......	......
55	American Ice Co	Mull Plaat	12,000	W.	*	*	......	......	......	......	......	......
56	Powell & Minnock	Coeymans	27,000	W.	*	*	......	......	......	......	......	......
57	R. Gardineer	Schodack	14,000	W.	*	*	......	......	......	......	......	......
58	J. N. Briggs	Coeymans	44,000	W. & R.	*	*	......	......	......	......	......	......
59	J. N. Briggs	Coeymans	32,000	W.	*	*	1	500	......	......	......	......
60	J. N. Briggs	Mull Island	22,000	W.	*	*	1	500	......	......	......	......
61	American Ice Co	Lower Schodack Island	60,000	W.	*	*	......	......	......	......	......	......
62	Miller, Whitbeck & Co	Mull Island	18,000	W.	*	*	......	......	......	......	1	500
63	American Ice Co	Barren Island	32,000	W.	*	*	......	......	......	......	1	500
64	Corwin & Son	Coeymans	13,000	W.	*	*	......	......	......	......	1	500
65	Ed. McCabe	Hotaling Island	30,000	W.	*	*	......	......	......	......	......	......
66	American Ice Co	Hotaling Island	50,000	W.	*	*	......	......	......	......	......	......
67	E. C. McCabe	New Baltimore	30,000	W.	*	*	......	......	......	......	......	......
68	Hyer & Watson	Hotaling Island	18,000	W.	*	*	......	......	......	......	......	......
69	U. M. Horton Ice Cream Co	New Baltimore	22,000	W.	*	*	......	......	......	......	......	......
70	American Ice Co	Hotaling Island	48,000	W.	*	*	......	......	......	......	......	......
71	Paul C. McCabe	Hotaling Island	40 000	W.	*	*	......	......	......	......	......	......
72	Paul C. McCabe	Stuyvesant	30,000	W.	*	*	......	......	......	......	......	......
73	A. J. Vanderpoel	New Baltimore	24,000	W.	*	*	......	......	......	......	......	......
74	C. Van Hoasen	New Baltimore	20 000	W.	*	*	......	......	......	......	......	......
75	Bronk & Gay	New Baltimore	25,000	W.	*	*	......	......	......	......	......	......
76	P. & C. McCabe	Stuyvesant	30,000	W.	*	*	......	......	......	......	......	......
77	Mrs. John Clark	Stuyvesant	32,000	W.	*	*	......	......	......	......	......	......
78	National Ice Co	Bronx Island	18,000	W.	*	*	......	......	......	......	......	......
79	New Jersey Ice Co	Stuyvesant	28,000	W.	*	*	......	......	......	......	......	......
80	Gorman & Anthony	Coxsackie	18,000	W.	*	*	......	......	......	......	......	......
81	Charles Gorman	Coxsackie	24,000	W.	*	*	......	......	......	......	......	......
82	American Ice Co	Rattlesnake Island	49,000	W.	*	*	......	......	......	......	......	......

Map No.	OPERATING FIRM.	Location.	Capacity, tons.	Wholesale (W.) or Retail (R.).	HOUSES HAVING PLANERS.		PROXIMITY OF HOUSES TO SEWER OUTFALLS AND POPULATION SERVED BY SYSTEM.					
							WITHIN ¼ MILE.		WITHIN ½ MILE.		WITHIN 1 MILE.	
					Elevator.	Field.	Number of sewers.	People served.	Number of sewers.	People served.	Number of sewers.	People served.
83	Ray Bros.	Coxsackie	6,000	W.	*	*						
84	American Ice Co.	Coxsackie Island	27,000	W.	*	*						
85	American Ice Co.	Coxsackie Island	47,000	W.	*	*						
86	American Ice Co.	Coxsackie Island	16,000	W.	*	*						
87	Merchants' Union Ice Co.	Newton Hook	60,000	W.	*	*						
88	American Ice Co.	Coxsackie	17,000	W.	*	*	3	1,000				
89	American Ice Co.	Coxsackie	45,000	W.	*	*			3	1,000		
90	Green & Biddell	Coxsackie	45,000	W.	*	*						
91	Welch Bros.	Coxsackie	65,000	W.	*	*						
92	American Ice Co.	Coxsackie	33,000	W.	*	*						
93	American Ice Co.	Pine Grove	45,000	W.	*	*						
94	American Ice Co.	Pine Grove	10,000	W.	*	*						
95	C. S. Rogers	Four Mile Point	19,000	W.	*	*						
96	American Ice Co.	Four Mile Point	52,000	W.	*	*						
97	American Ice Co.	Athens	40,000	W.	*	*						
98	W. A. Winner	Athens	21,000	W.	*	*						
99	Hudson River Ice Co.	Athens	32,000	W.	*	*						
100	American Ice Co.	Athens	70,000	W.	*	*						
101	American Ice Co.	Athens	70,000	W.	*	*						
102	Thomas Every	Athens	12,000	W.	*	*	2	150				
103	Arrow Ice Co.	Athens	32,000	W.	*	*	2	150				
104	S. M. Parker	Hudson	5,000	W.	*	*	1	3,000	2	9,000		
105	P. V. Washburn	Hudson	5,000	W.	*	*	1	6,000	2	9,000		
106	Nation Ice Co.	Hamburg	38,000	W.	*	*						
107	G. Seaman	Hamburg	49,000	W.	*	*						
108	American Ice Co.	Hamburg	24,000	W.	*	*						
109	Merchants' Union Ice Co.	Rogers Island	50,000	W.	*	*						
110	G. Seaman	Catskill	47,000	W.	*	*						
111	American Ice Co.	Rogers Island	29,000								3	2,400
112	American Ice Co.	Catskill	50,000	W.	*	*					4	2,800
113	American Ice Co.	Catskill	6,000	W.	*	*			2	2,200	5	3,000
114	American Ice Co.	Catskill	11,000	W.	*	*	2	2,200	4	2,800	5	3,000
115	Chauncey Smith & Low	Catskill	3,000	R.	*	*	3	800	5	3,000		
116	Thomas Hall	Catskill	2,000	W.	*	*						

117	Nelson Bros	Catskill	26,000	W.	*	*	......	......	......	......	......	....
118	American Ice Co	East Kingston	16,800	W.	*	*	......	......	......	......	......	....
119	American Ice Co	East Kingston	12,000	W.	*	*	......	......	......	......	......	....
120	Dwyer & Rafferty	Kingston	14,000	W.	*	*	......	......	......	......	......	....
121	Steep Rocks Ice Co	Kingston	40,000	W.	*	*	......	......	......	......	......	....
122	McGinnis Ice Co	Kingston	2,000	W.	*	*	......	......	......	......	......	....
123	American Ice Co	Kingston	13,000	W.	*	*	......	......	......	......	......	....
124	Fischer	Kingston	4,000	W.	*	*	1	1,000	......	......	1	19,000
125	Robert Mains	Kingston	5,000	W.	*	*	1	1,000	......	......	1	19,000
126	American Ice Co	Kingston	10,000	W.	*	*	1	18,000	......	......	......	....
127	Quinley	Kingston	3,000	W.	*	*	......	......	1	18,000	......	....
128	Daniel Zoller	Kingston	5,000	W.	*	*	......	......	1	18,000	......	....
129	American Ice Co	Eddyville	18,000	W.	*	*	......	......	......	......	......	....
130	American Ice Co	Port Ewen	36,000	W.	*	*	......	......	......	......	......	....
131	American Ice Co	Port Ewen	39,000	W.	*	*	......	......	......	......	......	....